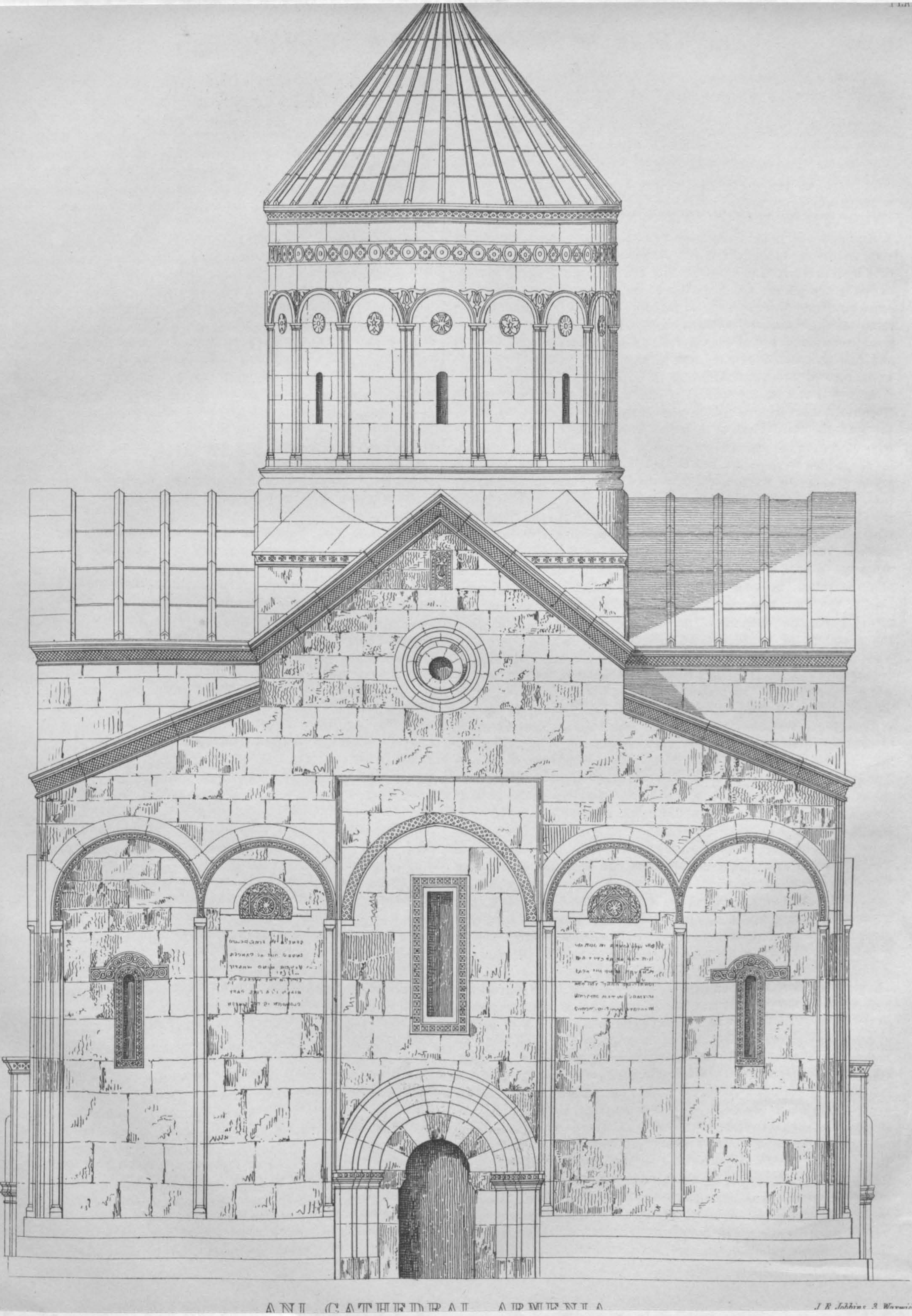

ANI CATHEDRAL ARMENIA

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ANI CHURCH IN ARMENIA.

Description of a church at Ani in Armenia, translated from the "Revue Générale de l'Architecture," 1842, *p.* 102.

(With an Engraving, Plate VII.)

By Professor Donaldson, Vice-President.

(Read at the Royal Institute of British Architects.)

Amongst the ruins of Ani are two churches in an almost perfect state of preservation, upon which Armenian writers have expressed both their censures and praises. We can form a sufficiently correct notion of the extent and character of the monuments mentioned in history. From the enthusiastic manner in which the Armenian authors speak of the metropolitan church at Ani, it would appear that it was considered one of the *chefs d'œuvre* of Armenian architecture, and that this temple was the type of all the religious edifices afterwards erected throughout Armenia.

At the time that the princes of the family of Pagratides were in tranquility, they removed their seat of dominion to Ani. Aschod I. received the royal crown of Armenia from Osdigan Ysa, in the fortress of Ani, in the year 885 of our era. Ten years later, Sempad, his son, added fresh possessions to his inheritance. He was, however, taken prisoner by the Arabs, carried to Tovin, where he died in torture. The throne of Ani was not, however, shaken by this blow; the Greek emperors signed a treaty with Aschod II., and the Armenian princes redoubled their exertions to render Ani a formidable station. Its situation was naturally strong, and they added fresh fortifications. I shall now examine in detail the most important edifices of these ruins. So long as Armenia was addicted to the superstitions of the East, she was the more naturally led to borrow from the arts of Persia, the elements of her national architecture. But when the preaching of Gregory the Illuminator had had its due effect, when the Armenians abandoned their ancient faith and adopted with ardour the Christian religion, a breach arose between the two people, which was signalised by wars and massacres, which terminated in an interested, if not sincere, alliance between the Armenians and Greeks of Byzantium. Whatever concerned the new religion, became an object of common interest to the two Christian nations. The Armenians had, perhaps, outstripped the Greeks, in their submission to the new law, but the ardent spirits of the latter were not satisfied with a mere speculative faith; they built churches and monasteries in all parts of the country, which came within the communion of the faithful. It was like a forcible possession, which the reactions of Paganism sometimes shook, but which they could never recover. We may trace in the progress of Byzantine architecture, the gropings of the first Christians to find a temple, which might give as a whole a striking symbol of Christianity. During five centuries, the Christians sought, without appearing to be satisfied. Hence it arises that in the religious monuments of the four first ages, is found the greatest variety, if not taste. They are, in fact, ancient temples, with the porticos closed to form the nave. At other times all the peristyle of the temple is enclosed within an exterior wall, and thus the Pagan edifice becomes an immense basilica. Some bishops built circular churches, or rather, as at Hieropolis, the church is formed of a certain number of beams simply covered by a roof, such as are now used for warehouses and sheds. After the fifth century, light broke in upon the Christian artists, which tradition expressed, saying that an angel had appeared to Justinian, in order to trace out for him the plan for his new temple, which model has been alone imitated, to the exclusion of all others throughout the whole Byzantine empire. There is no trace amongst the Armenians of this natural progress of an original genius. Being always the vassal empire of a foreign people, it yielded unconsciously to the influence of its neighbours, and adopted their arts and literature. We are unacquainted with the style of the Christian art in Armenia during the first seven or eight centuries of our era. The undecided character of the people was evident in all their compositions. Some of them are, however, not devoid of elegance, but in all there is a deficiency of strength and severity of character. The chief defect among the Armenian artists, was their ignorance of what we may call feeling for proportion, and not knowing how to adopt with propriety the ornaments of the masses of which they formed the decoration. Hence it results that the aspect of their buildings presents a cold and mean appearance, for there is no play of light and shade to give value to the large surfaces which only present small columns, without relief, on which the eye may repose.

This defect was not chargeable to the Byzantines, who generally sought in the façades of their buildings to produce striking effects of light and shade, by placing some harmonious relief between the surface of the solids and voids. The delicacy of detail was generally sacrificed to the mass, the proportions of the columns were rather heavy than slight, and they endeavoured to gain the height by raising the semi-circular arch one-fourth of its diameter above the springing. We recognise this character particularly in the edifices of the period of Basilicus and of Constantine Monomachus. The Armenians evidence in their choice of ornaments, more of the Arab than the Roman taste. All their details are executed with great delicacy. The use of columns is very restricted, they are usually engaged and take the place of pilasters. One of the edifices in the town of Ani, in which is found isolated columns, was constructed during the period when the Arabs were masters of Armenia; it is the monument near to which is a minaret, which I consider the principal mosque. Other columns belonging to the porch of a church, also, have capitals of the Arab character.

Upon surveying the circuit of the walls of the town, we recognise the exaggeration of the chroniclers of the times. Matthew d'Edessa thus expresses himself, in speaking of the royal city: "In 1064 the sultan Alp-Arslan, brother of Toghrul Bey, determined to conquer Armenia, and encamped before the royal city of Ani, which was then in the possession of the Greek Emperors. This town contained an immense population, and a thousand and one churches where mass was said." John Alathir, the Arab historian, records the same fact, but only mentions five hundred churches. "Arslan fixes the siege of Ani in the year 1064. This town was protected by two deep vallies; it contained some magnificent monuments, and one might count in it more than five hundred churches." To judge from the present ruins, it would be difficult to conceive that the number of temples dedicated to the Christian religion exceeded fifty, even including the baptisteries and the altars of cross-ways with their pictures.

But this people, who never had the instinct for great works, were satisfied with admiring monuments which are useful to study as the history of art, but which must not be compared to the edifices of the East, to the vast Latin basilicas, nor even to the mosques of Ismalism, erected by the Turkish or Seldjioukides sultans.

The peculiar character of the religious architecture of the Armenians, is the exclusion of the spherical cupola, which is replaced by a conical ceiling. This species of construction applied to the edifices of Ani, is also found in a great number of Arab tombs, in Cappadocia, which was in the possession of the kings of Armenia for several centuries. As these monuments are of a more recent date than those of Ani, there is reason to believe that the Seldjioukides adopted the spirit of the Armenian monuments.

The plan of the metropolitan church of Ani is composed of a nave, with transepts, in the centre of which is placed a dome, and side ailes. The entire length of the church is 105 feet, and its width 65 feet 6 inches, that is to say, the proportion of the edifice does not exceed those of some of our village churches. The dome is supported by four pillars composed of a group of shafts *(feiseaux)* which run up to the impost, and which are carried up so as to form a Gothic arch.

The lateral arches, which separate the nave from the side ailes, have their imposts at half the height of the large isolated pillars, and the higher arches spring from engaged pillars, the shafts and projections of which correspond with the isolated pillars. The choir is composed of a hemicycle, which is decorated with ten small niches, divided from each other by double columns. The altar is placed in the centre of the hemicycle, as is customary in the Armenian rites. A wooden screen, called by the Greeks *Khangelon*, extended from one extremity of the hemicycle to the other; it is to this screen that the curtains and tapestries, of which mention is frequently made, are attached. To the right and left of the hemicycle are two small sacristies, one to preserve the gospels, the other to contain the sacred vases; such is the simplicity of the plan of this edifice. Its decoration consists in paintings, which, however, time has destroyed; there now only remains in the choir some traces of the figures of the twelve Apostles. The whole of the interior of the church was covered with stucco, which has fallen off gradually. The central lantern is at this time dilapidated, the fragments have accumulated in the centre of the church; it is possible to recognize the greater part of the exterior decoration, and the system of covering is precisely the same as that of a neighbouring church, of which the lantern is still perfect.

The stucco in falling has laid open the stone used in the construction of the pillars. It is a volcanic tufo, which has the property of hardening on exposure to the air. The courses of the pillars are formed of alternate yellow and black stone, which recal certain constructions of the thirteenth century in Italy. This taste of zones of various colours was very general among the Mussulmen of Syria and Egypt. In Cairo, they are still careful to paint on their mosques horizontal bands with slacked lime and red ocre, but in other towns in the East these zones are made with different coloured stones. The first impression which is produced on entering this half destroyed nave, is a feeling of melancholy, on witnessing the nakedness of the stone and the coldness of the lines. The narrowness of the side ailes apparently increases the thickness of the pillars. But painting formerly enlivened these high walls, and the small quantity of light shed on the nave when the cupola was complete, must have given to the interior of this temple a melancholy and austere tone, which was in harmony with the grave character of the people who frequented it.

Those, who have observed the progress of the arts in the middle ages in Europe, will be disposed to consider this edifice as a work of the thirteenth century; it indeed bears the characteristics: but the date inscribed on the portal proves it to be far more ancient, and that the pointed arch was in use in Armenia at the period when the Roman style was the only one which was adopted in Europe.

The façade of this church, constructed with remarkable simplicity and decorated with great reserve, presents, however, an interesting subject, as it may be regarded as the type of the German architecture of the middle ages. It is easy to explain why, throughout this country, is found the dome with the conic roof peculiar to the Armenian architecture. After the taking of Ani by the Mussulmen, a great number of the citizens abandoned the town. They could not retire into Persia, where they would have been received as enemies. The Greeks in Byzantium, being equally hostile to them as the Persians, it was towards the North country they directed their steps. They were received by the kings of Georgia, and spread themselves over Moldavia as far as Poland, where they formed different establishments. All these countries, which were still immersed in ignorance, availed themselves of the knowledge brought to them by these new comers. Although a religious spirit was dominant among the Armenians, they were too timid to make any effort to promulgate their doctrines. The rising Christianity of those countries borrowed of them what they could adopt of their arts, but remained faithful to the ritual of the Greek church. The style of this architecture progressed by degrees towards the North. It was from them that the Russians imbibed their first elements.

The façade of the church is in harmony with the simplicity of the plan. All superfluous ornament is excluded. Slight engaged columns on the face of the walls support circular arches, which are raised a little above their centre. The middle arch, on the contrary, approaches the pointed form. Two semicircular panels to the right and left of the window, present to the eyes of the faithful the image of the cross, placed in the middle of an hexagonal star, surrounded by a foliage of flowers.

The three divisions of the nave are indicated outwardly by a pediment, which adjusts itself with the wall of partition of the cross, and by the two slopes of the roof which cover the side ailes.

This arrangement of the upper part was often employed in the churches of the middle ages in Europe. It is the most simple and logical arrangement. The cornices are composed of slightly projecting mouldings, separated by a rather broad fascia, decorated with a Greek scroll. Below the summit of the pediment there is another bas-relief, in the middle of which is a Latin cross placed in a richly sculptured frame.

This grouping is frequently repeated in various ways on the doors, monuments, and exterior walls. It was not only at Ani that this custom prevailed, the principal towns of Armenia were also decorated in the same manner. Ibn Alather, in his chronicle, makes frequent mention of this peculiarity. The town of Matian Neschin was surrounded by a wall composed of large stones, and ornamented with crosses fixed with lead and iron. The quarries of Ani furnished materials of various colours; they availed themselves of this opportunity to execute crosses in yellow and black mosaic. The façade of the church participated in this polychromatic decoration; but we cannot conceive what induced the builder of the church to work in, in an irregular manner, black and yellow stones promiscuously in the wall of the elevation. The quarries which produced the stones for the church are sufficiently abundant to have furnished all the materials they required. Three windows afforded light to the nave; that in the middle is square, surrounded by a broad framework, the two side windows are hardly wide enough to give light to the side aisles. There is an inscription on one side the door in the Armenian language, which states that the metropolitan church of Ani was built by Queen Gadramia, wife of King Kakig, the first successor of Sempad who laid the foundations of the edifice in the year 1010 of our era.

Hence it appears that at the time the pointed arch was unknown in Europe, monuments of the Gothic style were constructed in Armenia. At Diarbekir there is a very remarkable monument, which is now converted into a mosque, also constructed in the Gothic style. The Armenians call this edifice the palace of Tigranes, and there is nothing to disprove its having been the residence of this prince. The ground floor of this palace is embellished with columns in the Roman style, with Corinthian capitals of tolerably correct workmanship; these columns support a range of Gothic arches. The order of the first story is also Corinthian much enriched; the frieze and cornices are formed upon the principle of the Roman arch in the fourth century; the Gothic arch is, however, mixed up with this architecture, so as to indicate its common use in these countries. Although it is difficult to fix the precise date when the pointed arch was first used in architecture, we cannot form any positive conclusion as to the date of the monument in which it is found. Up to the present time this question is far from being decided, but it is very certain that the pointed arch is of eastern origin, since it may be traced in Mesopotamia long before it was known in Europe.

As to the arch greater than the semicircle, which we are accustomed to regard as Saracenic, it is of such rare occurrence in the West, that its eastern origin cannot be contested. It appears certain that it was first introduced into Europe by the Moors, but it may be observed in the eastern buildings, even before the birth of Mahomet. The Armenian church of Dighour presents a remarkable example of this kind of arches, their curve or rather the elevation of the centre above the line of impost is much more decided than in the church at Ani. It bears the date of 1164.

The lateral front of the metropolitan church at Ani is constructed in the same style as the principal front. The gable end of the cross is enlightened by a circular window, as on the façade: under this window is a kind of tympanum or table with a Gothic arch. This table projects very little, and has no particular decoration. To the right and left of the door there are two very elongated niches, or rather two species of sinkings, which correspond with cavities in the engaged columns. The same adjustment may be observed in the back elevation of the church. But there it is more defined, as it disengages the circular end of the hemicycle from the two side sacristies. This disposition is characteristic of the architecture of Ani. It may be noticed in the other church, which is in much better preservation than the cathedral, but which was not so much esteemed by the Armenians. No traces are to be found amongst these ruins of any staircase, nor of any vaults for purposes of sepulture. It was, however, the custom of the Armenians to inter the dead in churches, for we read in the geography of Vartan, that "the body of Gregory the Illuminator was brought from Constantinople, and was placed in a grave under the four columns of the church." The same author mentions a great number of relics found in the churches and monasteries.

One striking circumstance in this architecture is the ingenious manner in which the inhabitants availed themselves of the materials placed within their reach. The roofing is constructed with an art equal to that, which has produced the finest monuments of antiquity. The large tiles made of lava have their edges turned up at right angles, like the tiles of marble used in the temples; these two ends, applied one against the other, are covered by a continuous capping, and the whole is supported upon a stone vaulting. Hence it arises that in the construction of the edifice no wood has been employed; and although abandoned for five or six centuries, the edifices of Ani have suffered little from the effects of time. It is, in my opinion, a remarkable feature in Armenian architecture, to have been conceived in accordance with the materials so immediately within reach. Wood being scarce in the country, the use of it was entirely excluded. As lime is a substance very uncommon in volcanic formations, they learnt to do without it; whilst tufo of different consistence and divers colours were cut, chiselled, and sculptured in walls and capitals, in columns and vaultings, in great variety.

The century which followed that of the erection of the cathedral, witnessed the decline of the town of Ani, which fell into the hands of the Byzantine princes, who already possessed Kars and Erzinghan. The church, which was situated close to the river, appears to have been consecrated to the Greek ritual, as they had added before the entrance a portico or vestibule, which was always placed in front of the churches of this communion.

The two lower courses only remain of the lantern, but all the other fragments are heaped up in the nave. The lantern has been restored from these fragments, and from those of a neighbouring church which is exactly similar to that of the cathedral. The dressings of the door are also very little injured; the rest of the edifice is in perfect preservation. The whole of the monument is constructed of yellow and black lava.

ON THE CORINTHIAN CAPITAL.

Observations upon the very marked and varied style of composition exhibited in the capitals appertaining to the Temples of Jupiter Stator, and of Mars Ultor, and to the interior of the Pantheon at Rome.

By A. W. Hakewell.

The first and paramount duty of the architect being to select an appropriate form or outline for his building, he next considers the detail, with a view to give to the outline a suitable expression.

It is proposed, in the following observations, to take into consideration the subject of detail only, moreover directing attention to one sole feature of ornamental detail, viz., that triumph of human invention, the Corinthian Capital; with a view then to show how bent the ancients were upon giving expression to their works, in order that these, if it may be so expressed, should speak a peculiar and suitable language, it may be well to cite those admirable examples of the Corinthian Capital, left us by the Romans. But prior to entering upon the merits of particular examples of the Corinthian Capital, it may be allowable to refer to the composition itself, commencing with the account of its origin; and here we are indebted to Vitruvius for a simple and elegant story, the spirit of which, it must be confessed, is quite in harmony with the beautiful object to which it relates, and if not taken too literally, but on the contrary, properly entered into, will be found like most of the allegories of the ancients, to contain an important truth.

We are told that a maid of Corinth having died, her devoted attendant seeking consolation in the last sad offices, collected the favourite trinkets of the departed into a gracefully elongated basket, which she carried to the tomb, and secured there, by placing upon it a square tile; it so happened that a young acanthus shot up close to the spot, and entwined its leaves round the basket,

> " Flexile around its sides the acanthus twin'd,
> Strikes as a miracle of art the mind."
>
> Theocritus.

that the ends of the delicate stems meeting with resistance from the overhanging stone at the top, bent gracefully down, resolving themselves into spirals, which altogether produced so much of symmetry and variety of form, that the artist Callimachus, who chanced to see the composition, made a representation of it, and reduced it to the Corinthian Capital.

The graceful spirit of this metamorphosis will, of itself, secure to it an abode in our minds, but its utility gives it the greatest claim to our attention; linked as the story is with so masterly an invention in the ornamental department of architecture, it reminds us forcibly that art to be striking, must spring from the contemplation of nature; but not exactly from that species of contemplation inferred by this ingenious tale, which can be viewed in no other light, than as a graceful fiction setting forth the first principles of invention; it is to contemplation of a far more mental and abstracted kind, that we stand indebted for the ingenuity and grace exhibited in the design under consideration; we leave no scope to intellectual vision in this affair, and wholly discard originality, if we view it as a matter of fact; and yet there have not been wanting those who have inserted this story in their works, as a credible manner of accounting for the origin of the Corinthian Capital, whilst others have gone still further, and rendered it ridiculous, by graphically illustrating the subject, presenting us with the whimsical group of Callimachus with his basket of leaves. The inventive faculty requires no such broad hints, nor such palpable suggestions, but suggests powerfully itself, and from the slightest incidents; the primary objects which inspire an artist's thoughts, stand in no nearer relation to his matured conceptions, than do the juices gathered by the bee, to the honey to which she finally converts them.

First principles form the basis of his conceptions, but the power of combining is wholly dependent upon originality of feeling, and when taste and judgment are united to invention, then it is that the objects created assume that natural and easy aspect which prompts us to assign their origin to some production of nature; thus the graceful Ionic capital is said to be in imitation of a peculiar style of female head dress; the groined vaulting in Gothic architecture to the interlacing of the boughs of a grove of trees; and because the Corinthian capital does not exist in nature, we go about to make up a most improbable story, we require a trick, a harlequinade on the part of nature, merely because we are unwilling to admit the truth, and pay just homage to tho inventive faculty of man.

While discoursing upon the Corinthian Capital, it may not be amiss to remark upon the simplicity of the design itself—simplicity, that essential quality, the inseparable concomitant of all that is beautiful in nature and art, enters largely into the composition of this graceful work; nothing can be more easily understood than the plan of the Corinthian Capital; two circular tiers of leaves, one tier placed above the other, the centres of the upper leaves, corresponding with the spaces separating those of the lower tier; a stem giving birth to spirals jutting out at each of the four angles, the whole surmounted by a slab, concave on its outer edges, constitute this striking architectural feature; albeit the parts are few, still the effect is great; there is no appearance of effort; this is the result of simple intelligent arrangement. These are the lessons which teach us to value the sentiment so winningly expressed by the poet, when invoking simplicity he says—

"The flowers that sweetest breathe,
Tho' beauty culled the wreath,
Still ask thy hand to range their order'd hues."
Collins.

With a view to pursue the inquiry, the nature of which has been stated at the commencement of the foregoing observations, we may proceed to investigate the capital of the three remaining columns adjacent to the "Arco de Pontani," at Rome, in which we perceive at once a vigour of style truly surprising, so that we are in a great measure prepared for the discovery of its being a feature of a temple, dedicated to Mars the avenger; let us now direct attention to the means which are resorted to in this work of art, in order to its rightly affecting the mind of the spectator; we are made to feel that the pourtrayal of sentiment alone has been resorted to for that purpose: this intellectual aim absorbing every other less worthy consideration.

The Corinthian Capital had been frequently applied before this version of it appeared, and its usual mode of composition is strictly adhered to in this instance, the artist positively bringing nothing new to his aid save conception and style, and this circumstance alone invests it with abundance of novelty; we perceive, too, in this example, how entirely the artist has depended upon expression for the effect he aimed at producing; to be convinced of which, we need only bear in mind, how little the elements which enter into this composition relate to the attributes of the god of war; it is the spirit which those elements breathe which so affects the mind, and raises in it sensations so in harmony with the subject.

Thus conceived a fragment strikes the mind, whereas whole rows of entire capitals composed of spears, shields, thunderbolts and forked lightning, which elements, a false taste would readily substitute in this instance as more appropriate features, would have absolutely failed to make an impression, for the reason that such objects from their rigidly defined forms cannot by any possibility be made the vehicle of sentiment. Let us now restore in our minds this work to its pristine form and beauty, and picture to ourselves a number of them executed in a beautiful and durable material, borne aloft upon graceful pillars, which surrounded on all sides the temple, these seated upon a noble base and podium, and supporting sculptured frieze and pediment, the whole viewed under the influence of a brilliant atmosphere, and we behold a spectacle which the Romans gloried in, and which must have lifted their hearts to the utmost pitch of patriotic devotion, overawing at the same time the enimies of the state, by the demonstration it afforded of the lively sympathy entertained by the Romans for the avengeful spirit of the god of war.

It is interesting to know that this relic of ancient art was a great favourite with the immortal Michael Angelo, who was wont whenever he passed by it to express his admiration of its style, the turbulent character of which reminds us of what Agostino Caracci says of that of the great Florentine, "di Michel Angiolo la terribil via;" for in truth the style of this capital assimilates with the dread manner of Michel Angiolo. Such productions as these, of which there remain but too few in Rome, were congenial to the mind of that extraordinary man, and the contemplation of them no doubt greatly aided in developing his bias for the sublime. The following description of this temple by Sir Christopher Wren, is to be found in the "Parentalia," viz., "As studiously as the aspect of the 'Temple of Peace' was contrived in allusion to Peace and its attributes, so is this of Mars appropriated to war; a strong and stately wall of near 100 feet high is placed behind it, (because, as Vitruvius denotes, things appear less in the open air,) and though it be a single wall, erected chiefly to add glory to the fabric, and to muster up at once a terrible front of trophies and statues, which stand here in double ranks, yet an ingenious use is made of it—to obscure two irregular entrances which come from a bending street; and to accommodate itself as well to the situation, as to give firmness to the wall, but five feet thick, it is built in various flexures, (because a straight wall is easier ruined by tempests); these flexures give opportunity to form two other frontispieces, in which are seen niches much greater than ordinary, and may be supposed to contain the trophies. Thus stands the temple like the phalanx, while the walls represent the wings of a battalia:" and further in the same work, we have, "this and the Temple of Peace and the Pantheon, are those which Pliny particularly mentions among the most remarkable works of Rome."

Now if we institute a comparison between the above-mentioned capital, and the one appertaining to a building known by the appellation of Jupiter Stator, we shall find that they exhibit a marked difference of style. This last mentioned building was devoted to state purposes, such as the reception of ambassadors, the discussion of foreign affairs, and contained also the treasury; in order then that the style of this building should respond to its intention, it became necessary to invest it with a character expressive of Roman sumptuosity, which demanded throughout the details a display of unusual magnificence. We cannot sufficiently admire the intelligent manner in which this desideratum is obtained; for though in richness it borders on the very brink of redundancy, still there is nothing about it ungracefully gorgeous. In expression it differs wholly from the capital we have just been contemplating; yet the composition remains the same, as regards its essential features; nothing is retrenched, and nothing very important added; the only embellishment attempted that the other does not possess, consists in some delicate ornament upon the abacus, and the stems of the volutes. Although vigour of expression is not the aim in this instance, there is no lack of that quality; richness and grace are, however, the predominating characteristics of this bewitching production; independently of the extra embellishment already mentioned, which concurs in producing this effect, the individual leaves of the capital take a more lively and graceful form; but the most pleasing circumstance in this respect is the entwining the central spirals or volutes: this is truly a touch of inspiration, one of those thoughts that rarely occur, and then only in the artist's happiest mood, exemplifying most happily what is meant by "snatching a grace beyond the reach of art."

If we now pass to the consideration of the capital of the interior of the Pantheon, we shall find that it differs entirely in expression from the two we have already noticed; in those some one quality predominated, the vigorous or the graceful; in the present example those qualities are softened and blended into one another. It is gratifying to view these proofs of the mind disporting in the sphere of invention, passing boldly from extreme rigor and sublimity of conception, to that of gracefulness and delicacy of sentiment, then seeking, as it were repose in the calm atmosphere of tranquil thought; it is to be observed that the interior of the building to which this capital attaches as chief ornament, is of a circular form; a form more susceptible than any other of producing tranquil emotions in the mind of the spectator; the absence of all angles, with the uninterrupted continuity of line, have this tendency. Upon this subject it will be allowable to quote Sir C. Wren, who says, "no inclosure looks so graceful as the circular; 'tis the circle that equally bounds the eye, and is every where uniform to itself; but," he adds, "being of itself perfect, is not easily joined to any other area, and therefore seldom can be used."

We have now to bear in mind that the Pantheon was a temple dedicated to all the gods, the characteristic of the presiding deity being conveyed through the expression of dignified repose; the result, then, to be obtained in the interior of the Pantheon was, that in that mansion of the gods, the spirit of tranquillity should reign undisturbed, and that the spectator admitted within its precincts, whilst contemplating its wonders, should experience kindred emotions of the mind. It became important, then, that each and even the smallest detail should be designed in a way to contribute to this result; hence the quiet style of composition of so prominent an ornamental feature as the capital. It may here be repeated that the object proposed in the foregoing observations was that of showing how desirous the ancients were of rendering art expressive, and making it the vehicle of language, mute if we will, but not the less eloquent; and that they set more value upon novelty of sentiment than upon novelty of form; it is this intelligent manner of the ancients of treating architecture, that gives that life to their buildings, which makes even the decaying forms of the latter so attractive; as we gaze upon their fading beauties we are transported alternately by feelings of joy and sorrow; we imbibe their spirit, and seem conscious for the moment, of a new life, and to exist in the past. It is this intellect breathed throughout the works of the ancients, which makes them even in their decayed and ruined state so valuable as studies. He who can sympathize with the feeling which gave birth to those works, is possessed of a safe and faithful guide in the study of architecture.

The importance of the architect's well considering the style and expression of his building, is manifest, since he is bound by the laws and spirit of his art to aim at originality. We all feel that buildings possessing a suitable expression, never fail to arrest attention and inspire interest; but when they are shorn of this essential and soul-stirring attraction, they are passed by, as piles of hard materials, and nothing else, as a dead letter, not a language. It is to be observed, that the capitals of the three orders of architecture, owing to the conspicuous part they play in a building, and their being so susceptible of modified expression, with strict attention to the preservation of their original form and meaning, are admirably calculated both to receive and reflect a full impression of the character which it is sought to display; the same thing holds good in detail generally. If this be borne in mind in designing, novelty will occur as often as the destination of the building varies—and this circumstance should act as a warning to those persons who, thinking but casually upon art, are apt to taunt architects, with the slavish disposition of copying the ancients, because they make use of similar elements. In the way those persons mean, the ancients were copyists also, for they the ancients repeatedly imitated themselves. When at last the elements of classical architecture became defined, they were adopted as the elements of the art, and adhered to; and to adorn them with new and ever varying sentiment, became the study of the most imaginative amongst the ancients. Thus there are no bounds to the power of invention, save those which reason alone imposes—there is absolutely no such thing as being compelled to copy; all nature tells us so. Marvellous as the economy of nature is in adhering to forms created from the beginning, still she is continually presenting us with novelty, in the varied expression of those very forms. Thus as regards the human countenance, though one and all of the millions created are based upon the same foundation, what variety does it not present: we know the formation and construction of the features of the human countenance to have been the same from the creation of man to the present time; the infinite variety which it exhibits depending *entirely* upon expression; and who would wish for greater novelty? In this wondrous restraint, which all powerful nature imposes upon herself—in this marked economy of invention it is, that we see revealed much of the awful wisdom, which pervades all her works. *Sage novelty*, then, is the essence of invention; and in looking at those works of art which have furnished the subject matter of the foregoing observations, we are penetrated with the conviction that the artists who created them were inspired with a feeling akin to divine; that they possessed minds wherewith to explore nature's secrets, and to listen to her councils, for they have worked upon her plan; they have shown us by the marked variety which they have achieved in the repetition of one single object, the *true road* to novelty; let us then pay high homage to the works of antiquity; and this, not by servile imitation, but in taking them as guides to a higher source of learning, viz., the study of nature; thus, shall we, like the ancients, be enabled to seize that true spirit of originality, which acts as the Promethean fire, imparting to their wondrous works all their life and energy.

South-Eastern Railway.—Another explosion at Acre Flat, Dover, took place on May 5, for the purpose of removing another portion of the obstructing cliff. Forty barrels, or 4000 lb. of gunpowder, were employed, and disposed in three mines, two of which were 150 feet from the top, and driven in 50 feet, the lower one 200 feet, and driven in 30 feet. The mines were sprung by two 20-plate batteries, fired by Mr. Hodges. The effect of this explosion is precisely similar to those produced by the others which preceded it. It is everything the parties could desire. About 15,000 yards, or 30,000 tons, of chalky cliff have been disloged by this operation.

THE AERIAL TRANSIT MACHINE.

Analysis of the projected Aerial Transit Machine, and of the principles involved in its construction and employment.

(Continued from page 153.)

In our last number we endeavoured to exhibit in the most striking point of view some of the leading characteristics of that member of Mr. Henson's Aerial Transit Machine, by the intervention of which he purposes to accomplish its suspension and effectuate its transportation through the air. We showed that, presuming an angle of inclination considered most favourable for the success of the experiment, it would be necessary, in order to secure a permanent elevation in the atmosphere, that it should realise a rate of motion ranging from 240 to 280 miles an hour; [1] and this, virtually subservient to the relation between the weight of the machine and the superficial dimensions of the suspending plane alone. We say *virtually* subservient, because in fact these are the only elements of the case by which the degree of velocity necessary to maintain a continuous flight is essentially determined: for although an inferior velocity would suffice with a larger angle of inclination, this result would only be attained at the expense of a *more than equivalent* amount of propulsive force; the real bearing and effects of which will be considered when we come to treat of the *power* by which the apparatus is to be set in motion.[2] And this will serve to show the futility of those observations so copiously hazarded, respecting the probable attainments of the machine in regard of speed; some arguing for the possibility of a high rate, others contending for the necessity of a low one; some asserting that 100 miles an hour was not beyond the reach of its means, and others labouring to prove that 18 or 20 miles an hour, or the speed of the crow, was the utmost it was competent to realise; as if the rate of its

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[1] An erratum of some consequence occurred in the former part of this article, which was not observed in time to have it amended in the text; and as some copies were disposed of before the deficiency was supplied by the insertion of a note, we desire to avail ourselves of this opportunity of extending the correction. By an oversight, which we can only account for by the fact that the article in question was not completed till the day before it was published, the resistance in opposition to gravity, developed by the passage of inclined planes through fluid media, was computed to vary in the ratio of the *cubes of the sines* of the angles of impact, instead of the *squares of the sines into the cosines* of the same terms; whereby the rate of the machine necessary to maintain its elevation was considerably overstated. The proposition, omitting the consideration of the cosine, (which in so small an angle may be regarded as unity,) should have been enunciated thus; As $\text{rad}^2 = 1 : \cdot05^2 = \cdot0025 :: 3000$, the resistance in pounds equal to its weight developed by the plane at right angles to its course, moving with a velocity of 12 miles an hour : 7·5, the vertical resistance generated by the same plane at an angle of 3°, moving at the *same* rate; and, consequently, as $\sqrt{7\cdot5} = 2\cdot74 : \sqrt{3000} = 55 :: 12 : 240$, the actual number of miles per hour requisite to the support of the machine, near the surface of the earth. This quantity, to suit the diminished pressure of an altitude of 8000 feet has to be further increased in the ratio of $\sqrt{3} : \sqrt{4}$; from whence a rate of 280 miles an hour is deduced as the ultimate rate of the machine necessary to its complete success. It is in fact the *horizontal* resistance that follows the ratio of the cubes, while the *vertical*, or that opposed to gravitation, observes the ratio of the squares of the sines into the cosines of the omologous angles; and it is in this that consists the advantage of the principle involved in the plan before us; the former, which is the resistance opposed to the progress of the plane, diminishing so much more rapidly than the latter, which entirely contributes to its support.

[2] It is to be observed, that we have here made no account of the resistance which the solid parts of the machine are calculated to experience in their forced passage through the air, and of the influence which this resistance has in determining the conditions of its support. This will be more properly considered in the inquiry hereafter to be entered into, with regard to the moving power. In the mean time, we would merely observe that, the immediate effect of this new force, is to impose a slower rate of motion upon the machine, not as equivalent to its support, but as the result of an increased horizontal resistance, to be met and answered by an enlarged angle of inclination and an increased development of moving power. It will easily be seen that the omission of this force from our consideration hitherto, though apparently diminishing the requirement of velocity, does not present the difficulties of the case in an exaggerated, but in a really mitigated point of view. However diminished the rate in respect of this additional force, it will still require more power to accomplish it than the 240 miles an hour we have here abstractedly assigned to it.

progress was a voluntary accomplishment, independent of its support, and not the veritable means of that support itself, determined by the conditions of the case alone. These conditions we have shown to be the *weight* and superficial dimensions of the suspending plane: and by these conditions, in the present case, observing an inclination of 3°, we are referred to a velocity of 240, or more properly 280 miles an hour. A modification of these conditions, involving an enlargement of the surface or a diminution of the weight, is therefore, and absolutely, the only existing means by which any part of this velocity could be *effectually* dispensed with; a modification which, moreover, we showed to be equally necessary to its success in another point of view; the accomplishment, namely, of its descent, consistently with the preservation of human life, or even of the integrity of the machine itself. It only remains, on this head of inquiry, therefore, to make a few remarks respecting the particular *form* which Mr. Henson has adopted for this important portion of his aerial apparatus.

Where so much more is required to be done than can be easily accomplished, and the utmost that we can reasonably hope to arrive at is a very limited reduction of the essential difficulties of the case, a lack of proper economy in the disposition of our resources becomes a grevious error, and inevitably leads to the conclusion that chance or mistaken analogy rather than the legitimate inductions of science have had a share in determining the choice. To those who have not considered the matter or made it the subject of actual experiment, it may not readily suggest itself that the really effective obstacle to the accomplishment of an aerial navigation, upon the principle of the plan before us, consists in the difficulty of constructing a rigidly extended surface, of sufficient dimensions and sufficiently light to answer the purpose required of it. Apart from this there is literally nothing that interferes, nothing that has to be overcome: for in the attainment of this object are merged all the obligations in respect of *power*, which the want of it alone imposes, and which constitutes in its default the existing obstacle to success. The difficulty which is here alluded to, and which, be it observed, is interposed by nature herself, in the essential properties of matter, depends upon the ratio in which weight, or rather, its effects in pressure, increase in respect of the distance at which it is suspended from its fulcrum or point of support, and the impossibility of counteracting these effects by the intervention of any means which do not also add to the forces, by the operation of which their adoption in the first instance was required. The conditions of weight, and consequently the obligations of support, increase, as we all know, in the ratio of the leverage, or horizontal projection; and this with such effect, as very soon to confound the best directed efforts of the most ingenious architect to combine solidity and lightness with extension in a plane of any magnitude that is devoid of extrinsic sources of support. With these inherent and inevitable peculiarities, it scarcely needs to be observed, the main object to be aimed at by those who have occasion to construct a surface in which the qualities in question are required to be carried to their extremest degree, is to have a form for that surface the most compact, in which the largest area is contained within the least remote limits; an advantage which the circular alone of all others is pre-eminently calculated to afford. In Mr. Henson's scheme, however, this has been entirely lost sight of, and, for what purpose it would be hard to conjecture, a form has been adopted, in which the smallest extent of surface is obtained in conjunction with the fullest development of all the natural difficulties by which the case is peculiarly beset. The stringency of this observation will be the more readily perceived when we consider that the utmost amount of surface which Mr. Henson has been able to accomplish, (for we will not suppose he has stopped short of his ability in this most essential ingredient of success,) involves an extension of 75 feet on either side the centre of support, within which limits, had he adopted the circular form, he might with equal facility have comprised an area of exactly four times the extent; the very quantity we have already shown to be the least with which it would be possible to enable it to come with safety to the ground.

Besides this, there is another objection to the shape of Mr. Henson's plane, which deserves to be noticed; namely, the superfluous amount of horizontal resistance to which it is calculated to give rise. The force of resistance, it is well known, depends upon the direction of its development—is greatest when it is perpendicular, and diminishes with the obliquity of the impact. Now the whole of the resistance experienced by the opposing front of Mr. Henson's plane, is of the former description, and consequently the greatest it could by any possibility be made to encounter. Without pretending to form any estimate of the actual amount of this force, we shall merely observe that by the adoption of a circular or even an elliptical form, the greater part of it would have been effectively avoided.

Nor must the question of danger be altogether overlooked in criticising the properties of Mr. Henson's plane. Depending entirely for its stability upon the due strength and tension of the cords by which it is supported, it is easy to see how precarious must be that form of structure which at once involves the fewest number and the greatest length; where the whole weight, situated in the centre, is sustained by levers in one direction only, and where, consequently, the rupture of a single line of braces must be attended with the collapsion of the whole mass and its unrestrained precipitation to the earth.

To complete this survey, we will only add one more objection, which, though we have placed it last, is by no means the least characteristeric of those to the charge of which Mr. Henson's plane, in its present form, is liable; we mean the obstacle to its rectilinear motion, arising out of the exaggerated inequality of the forces which it is calculated to develop in its progress. If the opposite sides of the suspending plane be in any way productive of different amounts of resistance in passing through the air, (and no precision attainable by art can prevent this conclusion in some degree,) this difference acting continuously and through the intervention of a lever of 75 feet in length, will create a re-action destructive of the regularity of its progress, which it will require the application of considerable powers to be able effectually to counteract. Supposing, for instance, (what may inevitably be apprehended,) that a dislocation or distension of any of the numerous bracings by which the rigidity of the plane is to be secured, should occur on either side of the machine more than on the other, an alteration in the obliquity of the presentation of the sides must ensue, and a disturbance of the equilibrium of resistance, which if it be only equivalent to ten pounds (and at the rate of 240 miles an hour, the perpendicular resistance upon a single square foot of surface, would be equal to 288 pounds) at the distance of 75 feet from the centre of motion, would influence its course with a diversion equivalent to a pressure of 750 pounds, and acting continuously, occasion a constant tendency to move in the circumference of a circle, only to be resisted by a rudder of suitable dimensions; to the manifest retardation of its speed, and the consequent expenditure of a considerable amount of power.

Why Mr. Henson should have fixed upon this form for the construction of his suspending plane, we cannot pretend to surmise. All we can say is that, if it has been designed with a view to preserve any analogy with the bird whose wings appear to be similarly extended in flight, the design is founded in a mistake. The bird requires its wings to be laterally extended, that they may operate to the greatest advantage in effectuating its propulsion through the air. This purpose, however, in Mr. Henson's plan, is intended to be answered by another expedient; namely, the revolving vanes. To retain the form after the purpose has been superseded, is to defeat not to sustain the analogy designed.

We have not stopped to examine the various modifications which have been proposed in different quarters by way of improvement upon this part of Mr. Henson's machine. Two only of these modifications we would particularize, because they have emanated from, or obtained the sanction of, one justly celebrated for his scientific attainments, and especially in matters relating to the present subject: the first consists in doubling the amount of surface, by placing *two* planes, one over the other; and the second, in the adoption of a conical or curved surface, as it were sunk a little in the middle, instead of one perfectly plane, with a view to escape the oscillations which are otherwise apprehended to ensue. With regard to the former of these, there is no doubt the conception is just; but a closer consideration shows it to be impracticable. We have no hesitation in declaring that it would be absolutely impossible to construct two planes of sufficient magnitude, sufficiently remote from each other to allow them to be freely impinged upon, with sufficient strength to maintain that position so completely as to form but *one* object with reference to the power by which it is to be moved, consistently with any thing like the lightness that would be necessary to qualify it for the purposes of mechanical flight. With regard to the second, if it is meant to propose as a model the plan, of which a sketch is given in the number of the *Mechanic's Magazine* for the 8th of April, the same objection would apply. It would be quite impossible to construct it, or anything like it, of the proper size and strength, within the limitation of weight required by the essential conditions of the case. To which we would add, that we are inclined to consider the provision itself uncalled for. If a plane could be constructed of any form sufficiently light and large to serve the purposes of flight, it would be difficult to prevent it from assuming of itself a form analogous to that proposed. But we are, moreover, sceptical as to the properties ascribed to it, and the advantages which it is said to hold out. The freedom from oscillation which bodies of that form are stated to display in their progress through the air, and for the illustration of which we are referred to the case of the shuttlecock, we conceive arises partly from the additional distance of the centre of gravity below the plane of suspension, (which its form obliges, but does not restrict,) and partly from the diminished resistance it offers to the descent; no very great recommendation, one would suppose, where that propensity is the main difficulty to be overcome. But, in truth, the simplest form in all these cases is the best; and if a circular or elliptical surface cannot be made to answer the purpose required of it, it will be in vain to seek for it in a more elaborate construction or a more complex form. And thus much for the suspending plane.

II. The next in order of the parts of Mr. Henson's aerial apparatus which we have proposed to discuss, are the controlling appendages or fan-like expansions, the purposes of which are, as we are given to understand, to regulate the vertical and horizontal movements of the machine, and present an obstacle to the oscillations to which it is expected to be subjected in its course. And first with respect to this latter purpose, the appropriate instrument of which is a vertical web of considerable superficial dimensions, extending from the front to the back of the machine, bisecting the suspending plane, the mode by which it is designed to operate is, we presume, by the resistance to its displacement, which it would experience in the re-action of the surrounding air. Now this resistance, be it observed, is entirely independent of the particular position of the resisting surface, and would have been equally attainable, had it been horizontally instead of vertically displayed; in other words, had the projector, instead of appropriating to that end a special instrument, made an equivalent addition to the suspending plane. To this must be added, that by a vertical arrangement, an opposition is afforded to the oscillations, which tend to occur in one direction only; whereas, had the latter alternative been adopted, all the oscillations which could occur would have been equally provided against, while at the same time additional efficacy would have been conferred upon that part of the machine where it is most required. To have devoted a large, or *any* portion, of his resources to the accomplishment of a single purpose, and that of doubtful and secondary importance, when it might have been made equally conducive to another, and that most exigent and essential, argues a great neglect of economy in those particulars in which its unqualified observance is absolutely necessary to success, and a disregard, to say the least, of those principles upon which the operation of the chief members of the machine depends. It is exactly as if a person having only two horses, and a carriage which their united efforts were but just sufficient to move, were to keep one of them always in reserve, for the purpose of attaching it behind occasionally, when the carriage was going down a hill.

By the intervention of the second of these controlling appendages, we are likewise informed, is to be governed the ascent and descent of the machine in its onward course, and the mode in which we are given to understand this is to be effected, is by some disposition of it, similar to that of the tail of a bird, enabling it to regulate within certain limits the horizontal inclination of the suspending plane. Now in respect of this, the least we can say is, that it is an expedient equally unnecessary and inapplicable with the preceding. The position of a plane suspended *in equilibrio*, is a matter so readily affected, that he must have strange notions of the conditions of the case, who conceives it necessary to make a provision for the purpose in an extensive and cumbrous apparatus. It is not in fact by any modification of construction or application of special machinery that the object in view is necessarily or properly to be accomplished; but by a disposition of the appended weight equally simple and secure. A few shovels full of coal thrown from the front to the back of the fire, or the transfer of any of the aerial passengers from one part of the car to another, would at any time effect a change in the position of the whole floating mass, far more necessary, indeed, and difficult to guard against than to accomplish; and from the smallness of the angle of inclination, more than sufficient for the purposes which could ever in that behalf be required. For it is not, in truth, by any such modification of the *position* of the suspending plane that the ascent and descent of the machine is to be properly governed, but by a modification of the *force* with which it is propelled. The suspension of the machine *in transitu*, being the result of the development of a certain amount of resistance in the air opposed to gravitation, which resistance varies with the rate, and consequently with the force under which it is generated at a given angle, the conditions of this suspension, affecting the level of the machine's course, follow the exercise of this power; so that having a force equal to the propulsion of the machine at its highest elevation, its reduction to a lower level is the natural and simple consequence of a reduction in the energy of the force employed, and *vice versâ;* any modification in the obliquity of the plane which might be necessary to second this movement, being more than sufficiently attainable by the occasional disposition of the appended weight as before explained.

But the adoption of this device, sufficiently extravagant, even if conceived with a just notion of its effects, becomes doubly preposterous, when viewed in the light of a contrivance, not only unnecessary and inapplicable to the purposes for which it was intended, but absolutely producing its effects in direct contravention of the anticipated results of its operations. For what are the consequences of the modification in the obliquity of the suspending plane, to be brought about by the agency of this caudal appendage, as described by Mr. Henson, in the specification of his machinery, and inconsiderately adopted by all those, without exception, who have taken upon themselves the office of enlightening the public upon this interesting subject? Totally overlooking the circumstances upon which the actual suspension of the machine depends, and regarding it as it were a body endowed with the power of following with equal facility any course towards which it might happen to be directed, all alike concur in considering the disposition of the inclined plane as giving (so to speak) the *cue* to the appended body; so that having attained an elevation in the bosom of the air, all that is necessary to increase that elevation is to augment the angle of inclination, and, *vice versâ*, to diminish the elevation, it is only requisite to decrease the inclination of the suspending plane. Now the whole of this reasoning is false, and the consequences in fact directly contrary to what they are here represented. So far from the direction of the plane indicating and controlling the course of the machine in the way described, paradoxical as it may appear, the modifications in question would be productive of exactly opposite results; as will be evident to those who consider the conditions upon which the support of the plane *in transitu* is really dependent. The resistance developed upon the under surface of the plane and resolved in a direction opposed to gravitation, which is the true grounds of its support, following the ratio of the *squares* of the sines into the cosines of the angles of inclination, while the horizontal resistance, which is the measure of its propulsion, varies as the *cubes* of the sines of the same angles, any alteration in the obliquity of the plane must affect the latter more extensively than the former, and determine a balance in favour of that condition which is most in conformity with the change; if it be to *diminish* the horizontal resistance (which is the result of a diminished angle of inclination), increasing the relative effects of the vertical, which is the medium of support; and if to *increase* the horizontal resistance, (which is the consequence of augmenting the inclination) to disparage the vertical resistance, and incontinently subtract from the ascensive powers of the machine. Accordingly, therefore, if the machine be progressing with a given force, and it be desired to *rise*, this result will be accomplished by *reducing* the inclination of the suspending plane, and on the other hand, if the angle in question be *enlarged*, it will immediately begin to *descend;* the rate in the former instance increasing and in the latter diminishing with the alterations in the obliquity of the plane, and the accompanying alterations in the level of its course.

With regard to the remaining purpose of these controlling appendages, corresponding to the horizontal steerage, of the aerial vessel, but little needs to be observed. Having no forces to contend with which operate to favour one direction more than another, except such as may arise from the unequal resistances occasioned by the opposite sides of the machine itself, any amount of artificial resistance beyond what is thus indicated, if properly applied, is sufficient to give a preponderance to any course which may be chosen; the only advantage of a more liberal supply being in the limitation of the space within which it enables the aeronaut to effectuate his purpose—an advantage of no great consideration in the abundant regions of the sky. In this respect the case of the aerial machine is most favourably distinguished from that of the ship at sea, pursuing her course under the influence of the wind; where the force by which she is propelled being frequently oblique, and in a sense adverse to the direction of her route, she requires a *given* power, not only to *obtain* a course but to *keep* it, and the conditions of which are governed by those of the force to be opposed.

It only remains to observe, in answer to the objections of those who imagine that, in the tenuity of the medium, exists an impediment to the efficiency of the rudder, that these objections are founded upon an imperfect consideration of the principles of the case involved. The impediments to the efficiency of any instrument are equally dependent upon the obstacles to be overcome as the means of overcoming them. Where these arise out of the same conditions, there can be nothing in the conditions themselves to influence in either way the success of its operations. And this is the case exactly with respect to the guidance of the aerial machine by means of the rudder. The obstacle to be overcome and the means of overcoming it are the same—namely the resistance of the air; in proportion as the weakness of this condition operates to disparage the powers of the rudder, in exactly the same proportion does it operate to disparage the forces by which the action of the rudder is opposed.

III. We now proceed to examine the third subject of investigation which we proposed to ourselves in the outset; namely, the revolving apparatus, by the reaction of which the impetus is to be maintained, which is to determine the progressive motion of the machine. These instruments may be most succinctly described as both in form and operation resembling the rotatory portion of a windmill, only consisting of *six* arms instead of *four*, about 10 feet long (the breadth not stated) and inclined to the plane of their revolution at an angle of 45 degrees. Being two in number (one on each side of the centre of gravity) in the same plane, and facing the direction of the intended route, that part of the resistance they are calculated to generate by their forced rotation which is perpendicular to the plane in which they revolve, becomes available to the propulsion of the machine, and constitutes, in fact, the measure and the means of its success. As it is clear, by the obliquity of the impact a certain quantity of the force which is developed becomes resolved in directions not favourable to the object in view, before any thing can be pronounced with certainty as to the efficiency of the means at command, it must be determined how much of these means is really turned to account—how much is realized and how much lost in the process by which it is conveyed from the source to the object upon which it is intended to act.

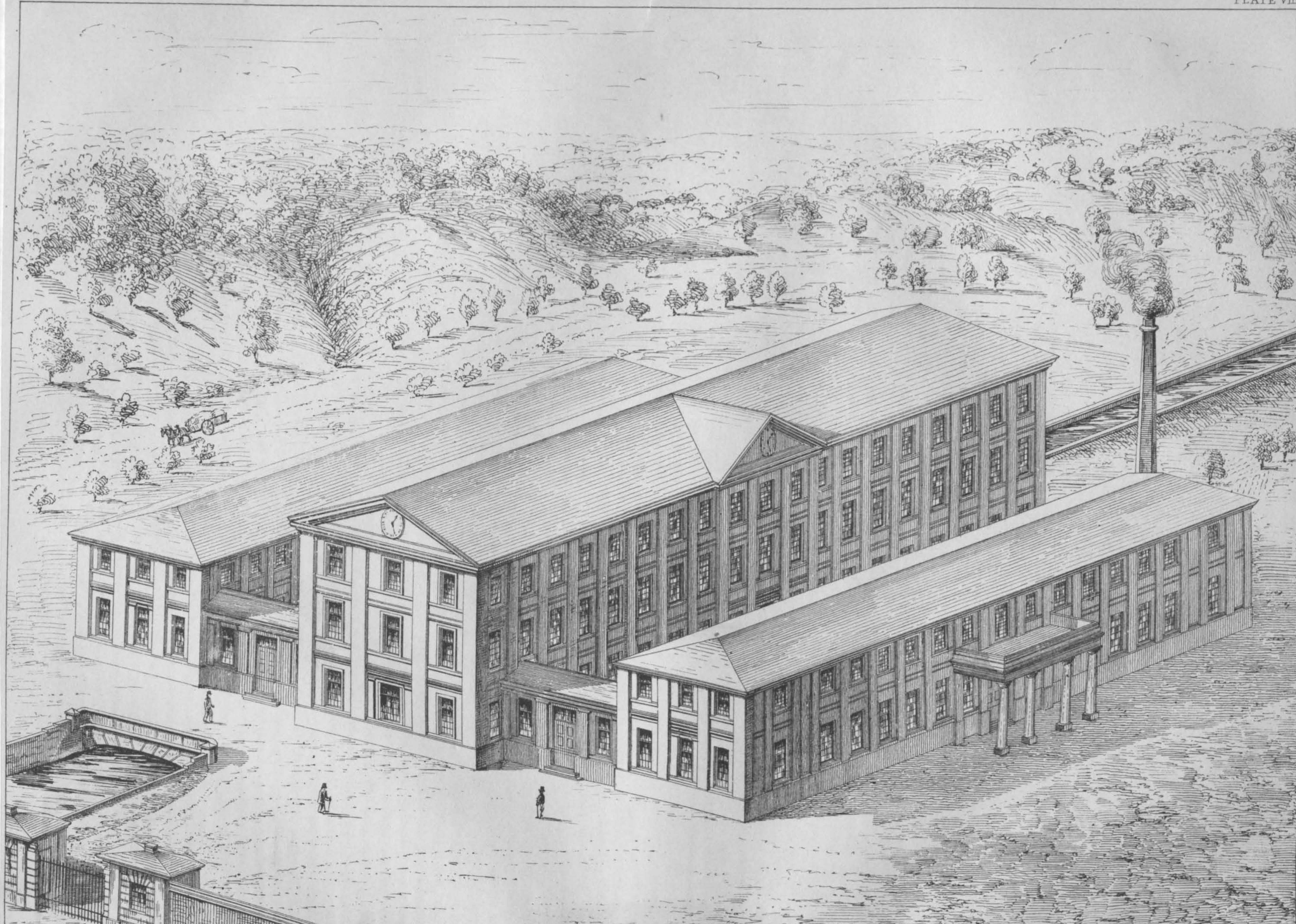
In determining the efficiency of any system of impinging planes, there are *three* elements concerned in the constitution of the force developed, which require to be considered—the *angle* of inclination, the *number*, and the *size* of the impinging surfaces.

Of these elements there is one only the actual amount of which is independently determinable—we mean, that does not regard the other conditions of the case, but has its *maximum* effect assignable with reference to itself alone—and this is the *angle of inclination.* Whatever this be that may be found to be best suited to the purpose, it will still continue to be the best under all modifications of size and number, rate of motion and condition of medium, which may happen to characterize the case. Now this angle, (that whereat an inclined plane is calculated to develop the greatest amount of resistance at right angles to the direction of the impinging force,) has been already determined, both by mathematical induction and actual experiment, in a strictly analogous case; namely, that of the windmill, in which the conditions both of the object and of the means are precisely the same: for it will not be considered to constitute any difference, whether the plane be impelled against the air or the air be directed to act against the plane. In both cases the object is to develop the greatest amount of atmospheric resistance at right angles to the direction of the impact; and the angle at which this is complete has been established to be an angle of 54° 44′. The arguments, both mathematical and experimental by which this conclusion has been sustained, may be found in most works upon pneumatics; but we abstain from quoting them here, because we have a shorter way, and more open to the comprehension of the general reader, by which the same is ascertainable, and which, moreover, by the almost perfect coincidence it presents with the result deduced from other sources, serves at once to illustrate and confirm the correctness of the general inference. We have already had occasion to observe that the ratio of the degrees of vertical resistance, developed by inclined planes moving horizontally, (which is exactly analogous to that the conditions of which we are now investigating) follows the ratio of the squares of the sines into the cosines of the angles of inclination. Accordingly whatever be the angle of which the sine squared, multiplied by the cosine, is the greatest, the same must also be the angle most favourable for the production of the required resistance. This actual computation enables us to fix at 54° 46′, differing only by *two* minutes from that otherwise assigned; as any one who pleases may verify for himself by consulting a table of natural sines, and applying the test to the corresponding sines and cosines of the angles, differing only by one minute on either side, taking four places of decimals in the estimation of the quantities concerned.[3] By what process of reasoning Mr. Henson was led to adopt, for his impinging vanes, an angle of 45° we cannot presume to conjecture; unless, observing that in the opposite conditions of perfect parallelism and direct uniformity of plane, answering to the angles of 90° and 0°, no available resistance at all was generated, he came to the conclusion that the proper resting place was the half way house between. Be this how it may, by assigning an angle of 45° as the inclination of his impinging planes, he has exactly sacrificed *one twelfth* of the whole amount of his resources, as may be seen by comparing the sines squared multiplied by the cosines of the angles of 45° and 54° 46′ respectively, which are subjoined in the note below.[4]

With regard to the two remaining elements of the case referred to, the *number* and *size* of the impinging planes, the amount of their effects in action being not only governed by an indefinite power of arrangement (being themselves unlimited in extent by any specific terms), but moreover, (in theory at least) entirely subject to the influence of another condition—the rate of their operation, it is clearly

[3] The products of the sines squared multiplied by the cosines of the angles of 54° 45′, 54° 46′ and 54° 47′, are respectively ·38483, ·38488, and ·38477; whence it is apparent that the *turning point* is the intermediate angle.

[4] The sines squared multiplied by the cosines of the angles of 45° and of 54° 46′ are respectively ·35347 and ·38488, which is very nearly in the ratio of 11 to 12.



FLAX & HEMP SPINNING & WEAVING MILL _ CASSANO DADDA, LOMBARDY

CONSTRUCTED BY B. ALBANO M. INST. C.E. &c. LONDON

J.R. Jobbins Litho. Warwick C^t. Holborn.

impossible precisely to define the actual quantities or proportions of each which are calculated to produce the greatest amount of resistance available to the purpose in view. But though we are thus precluded from appointing any specific terms to the size and number, in like manner as we have been able to do with respect to the obliquity of the impinging planes, yet are there certain considerations by which these conditions are affected, and under which a rough estimate may be formed of their efficiency or aptitude to perform the work assigned to them. These considerations are drawn from the properties of the medium, and the obligations of speed imposed upon the aerial vehicle by the already stated exigencies of its support. It is well known and easily conceivable, that when surfaces of any specific dimensions are set in motion, a disturbance of the equilibrium of the density of the air must ensue proportioned to the extent and speed of the impingin g planes. Now if the system of planes by which this disturbance is effected, should be so constituted as that they come in succession into the same or adjacent portions of the atmosphere before this equilibrium shall have been restored, they no longer operate in or act upon a medium of equal resistance to that by which the other conditions of the case are governed, and upon the hypothesis of which their own effective power has been calculated; and in fact, if this state of things be extreme, so that either by reason of the proximity of the planes or the rapidity of their succession, they pass over the space allotted to them in the same or less time than the air takes to rush into a vacuum (which is at the rate of about 1339 ft in a second) they would no longer have any medium at all to act upon, and consequently be productive of no amount of reaction, however great their number or their size. To mitigate these consequences there are two modes of proceeding; either to increase the distance between the planes, or to diminish the velocity with which they are impelled. Now to the latter of these we are precluded from having recourse by two considerations; first, by the general consideration that, as *rate* is the condition of impact upon which the actual amount of the resistance of a given plane entirely depends, to subdue the rate is to impair the efficiency of the machine *essentially* and without regard to any particular disposition of its parts; and, secondly, because a rate of motion the highest, probably (if not indeed higher than any) that will be found attainable, is required by the condition of rate assigned to the aerial vehicle itself, which rate must at all events be *equalled* by that of the instruments of its propulsion; for it requires no great process of reasoning to perceive that by no appointment of propulsive machinery can a body be indued with a greater rate of motion than that at which the propelling agents are themselves proceeding; so that it will be readily admitted the contemplated relief cannot with propriety be expected from the diminished speed of the impinging vanes. To increase the distance between them is therefore the only available means of sustaining the propulsive energy of the revolving apparatus, which in a construction of prescribed dimensions can only be accomplished by restricting the number; and the only question that remains for our discussion is, whether this condition has been sufficiently regarded in the plan before us. Now this question can be answered satisfactorily by reference to experiment alone; to experiment, with the particular machine in the process of its construction, or to general experience in operations of the same description. To the former of these, of course, we have no means of referring, but to the latter we have happily some pretensions; and in accordance with that experience, we have no hesitation in alleging a very great redundancy in the number of the impinging vanes in Mr. Henson's propelling apparatus, viewed with reference to the special object for which they are designed. Indeed, so convinced are we of the prejudicial influence which even *one* superflous member in a system of revolving vanes is calculated to exercise over the effective product of their impact, that we feel quite assured that had the number of arms been but *three* or even *two*, instead of six, in each compartment, they would have realised under the prescribed conditions of the case, a very superior amount of atmospheric reaction; perhaps the greatest that with an equal amount of surface it would have been possible to have accomplished. We know that to this it may be answered, that in truth the modifications alluded have been tried, and that it was not until the superior efficacy of the larger number had been attested and approved, that the present arrangement was ultimately adopted. But before we admit any force to this conclusion, we must be satisfied that the experiments upon which it is based, embrace all the modifications to which the conditions of the case are liable; that not only has the proper angle of inclination been equally retained throughout, but that the efficacy of the machine has been tested in all cases at its *utmost speed*, and subject to an equable distribution of surface according to the varying circumstances of the case; for there is no doubt that with a subdued rate of motion a larger number of the *like* planes will produce a greater amount of resistance, or that a larger number of planes will produce a greater amount of resistance than a smaller number of the same planes, where the rate of their motion is not such as to require an augmented interval between them to preserve the integrity of the resisting medium.

And here, in concluding this branch of our investigations, we would just briefly warn our readers against a very common and fallacious mode of regarding the operation of this particular sort of instrument, (which may not inaptly be termed the "aerial screw,") by which many are led to overlook or reason away the obstacle here set forth to its success; namely, that this obstacle, arising from a rapid action of the parts in a circumscribed space, would be avoided by the anticipated result of the operation—the progress conferred upon the machine—whereby they would be constantly introduced into fresh portions of the resisting medium; in other words, that the ultimate success of the undertaking will be an efficient means of removing the difficulty by which that success is mainly threatened. The argument is absurd to a degree. It is a *petitio principii* of the most flagrant character; because, not only is the insufficiency of the grounds of the progressive motion of the machine (the impoverishment of the medium) here set forth as the thing to be cured by the result of its own operation, but, the truth is, the very progress of the machine, apart from the operation of the vanes, is itself a main contributer to that deficiency, the effects of which it is expected to repair, in the withdrawal of the medium by the advance of the body within it, imposing fresh obligations of speed upon the agents of its propulsion to enable them to realise the prescribed amount of resistance. It is an argument not merely in a *circle*, but (if we may be allowed to coin a figure) in a *spiral*, in which the premises are rendered even *less* consequential by the conclusion which they are intended to support.

We have now left, of the questions we originally proposed to consider with reference to Mr. Henson's scheme of flight, the *power* by which the parts are to be indued with motion, and the *principle* upon which a first impetus is expected to be acquired. The insufficiency of the one and the fallacy of the other we purpose to expose in our next number.

NEW FLAX MILL AT CASSANO D'ADDA, IN LOMBARDY.

(With an Engraving, Plate VIII.)

We give in this number a plate showing a perspective view of the Flax Mill at Cassano in Lombardy, erected under the immediate direction of Mr. Albano, C. E., of London, and which at present is exciting much attention on the continent. To us it has additional interest, as attesting the wide diffusion of English industry, the whole of the millwright work having been supplied from the works of Mr. W. Fairbairn of Manchester, after the designs of Mr. Albano. It serves to show at the same time the field of employment open to the English manufacturer, and the resources available to foreign enterprise, who are thus able to carry out their own plans, and to profit by the proficiency and talent of the best factories in the world.

The following description of the manufactory we extract from a report of Giulio Sarti, the government engineer, who with his colleagues surveyed the building at its completion, on the 31st of December last.

"The general plan of the manufactory consists of three buildings a large one in the centre containing three floors, and two lateral of two floors each; one of the small buildings serves to deposit and to prepare the raw materials, the centre one for the spinning, and the third for power-loom weaving. This separation into three buildings is requisite, by the diversity of the processes to be worked, which could not be mixed together in a single building. The ground floor of the whole building contains an area of nearly 40,000 square feet, and are constructed fire-proof; of this, the main building is formed of two rooms, with a central staircase, the interior dimensions of each being 90 feet in length and 45 feet in breadth, with 16 columns in two rows, 14 feet in height, of granite shafts and cast-iron Doric capitals, supporting cast-iron beams, and brick vaults. The first floor is formed of two rooms with cast-iron columns 12 feet 6 inches in height, with tasteful Egyptian capitals, and a floor above it, 12 feet high, in the roof of which advantage has been taken to make reel rooms, which are very convenient in a large manufactory. In consequence of the superior arrangements of the building, it is capable of containing 8000 spindles. The motive power of the whole manufactory is an hydraulic breast wheel, worked by water taken from the river Adda, which runs through the building, and has a fall of 9 feet; this wheel is a stupendous piece of mechanism, fit for a model to any manufacturing establishment of the kind. It is 16 feet diameter and 21 ft. wide, the whole of cast and wrought-iron of about 36 tons weight; she takes and discharges the water with the most perfect regularity: on each side there is a large tooth segment, each working a pinion, which transmits the motion to the three different buildings. The regular speed of the wheel and transmission of motion are regulated with true perfection, and the mode in which the fixings and supports are fastened to the buildings is such as to guarantee their position unalterably.

"The cast-iron sluice, which admits water to the channel, prevents anything floating into the wheel; the cast-iron cistern and shuttles, (which supply the water to the wheel, according to the greater or less number of machines at work,) together with the speed of the wheel, are regulated by a centrifugal governor; the elevating machines which carry the whole work from one floor to the next above it, the means to supply the boiler with water, and the fire-pump in case of fire, &c., are all improvements which manifest the superiority of such an establishment.

"The spinning machines were chosen after mature consideration, among those possessed by the most celebrated spinning establishments in Europe, that can give in the greatest quantity and finest work, and among these, the preparing ones are admired for containing the most recent improvements."

We regret that a misunderstanding arose as to the original designs of the machinery, in consequence of a letter signed S. N. S. in our last number, wilfully misrepresenting the facts. On the present occasion we beg leave to call attention to the following correspondence, fully asserting and confirming Mr. Albano's claims, which ought never to have been disputed.

Sir—My attention has been drawn to a communication signed S.N.S. in the last number of your interesting *Journal*, page 181, relating to the Flax Mill at Cassano in Lombardy, in which the anonymous writer commences by attributing to you a slight mistake, by stating in a preceding number, at page 143, that Mr. B. Albano, C. E. of London, was the erector of the works, in order to subjoin the gratuitous assertion, that Mr. Albano was the superintendent of the building of that mill, whilst the mechanical work, mill-gearing, &c., were solely constructed by Mr. W. Fairbairn of Manchester.

In the name of justice, Sir, which has been scandalously invoked by S. N. S. in utter disregard of truth, (and as Mr. Fairbairn promptly wrote to Mr. Albano, saying "*I beg to state, that I am in no way connected with such a communication, nor do I know anything of the writer,*") I beg to submit to you a short account of the real facts of this case, in which I have been acting as agent in this country for the proprietors of the said mill, and consequently I am fully qualified to place all parties in their right position.

As far back as 1839, I have been commissioned by the director of the said proprietors, to procure of several professional gentlemen in Belgium, Leeds, and London, information and estimates for the construction of a flax-mill, and to that effect I applied also to Mr. B. Albano, who furnished full particulars. His plan and report having met with the sanction of the directors, I was further requested to send Mr. Albano to Milan, in order to survey aud fix on the proper site for the establishment, which he did, on the express condition, that the direction and execution of the whole work should be entrusted to him without any interference, and accordingly he completed in Milan the required plans, and obtained full sanction thereto, with ample power to execute the work according to his own design.

This preliminary will, I trust, be sufficient to contradict the first part of S. N. S.'s assertion, and I can easily prove the second part equally wrong, when I inform you that upon Mr. Albano's return from Milan, specifications of the required millwright work were sent out to several manufactories in London, Manchester, and Dundee, for their estimates, and on Mr. W. Fairbairn calling at Mr. Albano's office, the plans were shown to him, in my presence, to which he suggested some organic alterations, but on Mr. Albano's observing that they would increase the expense, and be otherwise objectionable, were soon set aside, and Mr. Albano, then proceeding with his own plan, in all its details, chose, with due regard to perfection and economy, to give the order to Mr. W. Fairbairn.

To that effect a contract was entered into, the first clause of which stands thus: "With the sanction of B. Albano, Esq., C. E. Directing Engineer of the said Company, &c., the machinery contracted for in the present agreement will comprise the following articles of millwright work, &c., for the organization of the flax and hemp mill of the said company, now in progress of construction at Cassano in Lombardy, under the immediate direction of the said engineer, B. Albano. The whole of the following millwright work apparatus, &c., are to be executed strictly according to the disposition shown, and dimensions marked, in Mr. Albano's drawings, Nos. 1, 2, 3, 4, 5, 6 and 7, and the following specification respectively signed by Mr. W. Fairbairn, contracting party, and the above engineer."

The mere quotation of the clause demonstrates, that the merit of the designs for the whole machinery alluded to belongs solely to Mr. Albano, and I may further add, that the whole design is different from the mode generally adopted by Mr. W. Fairbairn in constructing mills, as the architectural style, proportions, &c. of the buildings, and arrangement of the water wheel and machinery, are essentially original and distinct, erected under Mr. Albano's immediate direction, and pronounced by the body of Government engineers (whose report of their official inspection of the mill I beg to enclose) to be replete with great ingenuity, and conferring the greatest credit to the directing engineer.

The directors likewise, highly satisfied with his ability, energy, and personal assistance, from the commencement to the last, testified their gratification on the starting of the mill by presenting Mr. Albano with an elegant and valuable gold snuff box, bearing an inscription to that effect, and intrusted to his care fresh extensive orders.

Having so much trespassed upon your indulgence, I shall trust to your kind desire to do justice to all parties, the insertion in your publication of this statement of uncontrovertible fact.

5, White Hart Court, City, May 22, 1843.

Your obedient servant,
Henry Pagani.

Sir.—My attention has been directed to a letter signed S. N. S. in your last *Journal*, wherein it is stated that Mr. Albano, C. E. had appropriated to himself nearly the whole, if not the whole of the merit belonging to the erection of the Flax Mill at Cassano.

Now, in justice to that gentleman, I beg to state, that I know nothing of the writer of the letter above alluded to, and although I may have assisted Mr. Albano in the mechanical arrangements of the mill, I must nevertheless disclaim any connexion with the original project or designs which were exclusively his.

I am, Sir,
Your very obedient servant

Manchester, May 17, 1843. W. Fairbairn.

SUBSTITUTE FOR GLAZED FRAMES IN HOTBEDS.

In the *Rheinlandische Gartenzeitung* is described a substitute for the glazed frames of hot-beds and green-houses, which deserves the attention of florists. Instead of glass the frames are covered with a fine white cloth of cotton. In order to render this more transparent, and enable it to resist moisture, it is covered with a preparation, the ingredients of which are four ounces of pulverised dry white cheese, two ounces of white slack lime, and four ounces of boiled linseed oil. These three ingredients having been mixed with each other, four ounces of the white of eggs, and as much of the yolk, are added, and the mixture is then made liquid by heating. The oil combines easily with the other ingredients, and the varnish remains pliable and quite transparent. The expense of a forcing bed arranged in this manner is inconsiderable, and it yields at the same time many other advantages. Such a hot-bed needs not the anxious attention required by the ordinary one covered with glazed frames. During the strongest rays of the mid-day sun they do not require any particular covering or shade; the atmosphere therein preserves a nearly equable temperature almost the whole day, and requires only to be changed from time to time, according to circumstances. If such a bed is provided with a soil of horse-dung, and a proper thickness of some fertile, finely sifted heath mould is spread thereon, layers of all sorts of flowers, early vegetables, and other plants, may be reared from seeds in it.

CANDIDUS'S NOTE-BOOK.

FASCICULUS XLIX.

"I must have liberty
Withal, as large a charter as the winds,
To blow on whom I please."

I. Many others besides myself have, no doubt, frequently been not a little disappointed, on finding how very poor a building, that has promised tolerably well during its progress, has eventually turned out to be. So long as it was encumbered with scaffolding, and nothing could be made out distinctly, there was room for the imagination to work upon it; but when all is cleared away, then also does the poverty of the design become exposed to view—all faults and defects become apparent; and perhaps you find that when completed, the structure is altogether *unfinished.* Yet "*finish*" is one great secret—and truly a far greater secret than it ought to be, in architectural composition. Nor is "finish" to be confounded with decoration, for there may be the first with little of the latter; and a very great deal of the latter, with nothing at all of the first. Without finish, decoration generally looks trumpery and meretricious, and what is intended for simplicity, shows no better than inconsistent parsimony, and therefore shabby meanness. In fact, finish is essential to simplicity; and of this, Grecian architecture might long ago have convinced us, had we studied it in an artist-like spirit, instead of merely consulting its orders as so many patterns of columns. One rule worth a hundred of those usually given in architectural books, is, never attempt a higher degree of decoration than you can finish up to in every respect; since otherwise, do as much as you will, the ensemble will always be unsatisfactory. There may be both tasteful ideas and beautiful parts—but they will be only parts, causing by their very beauty all the rest to displease. Attention to what seem trifling matters, is a most important matter itself in architectural design, for it frequently constitutes the chief difference between what is excellent and what is poor—between what is captivating and what is dull commonplace. Yet because it happens to be what people call "*Only that,*" little regard is paid to it, although the *onlyness* of it, renders the neglect of it all the less excusable. Oh! if we had but all the "only thats" which people give us to understand they could easily accomplish, did they but think it worth while to attend to such trifles, how very superior we should become in art!

II. Of opportunities in architecture there are two sorts—the most obvious and intelligible one, that of having a building to execute which affords some scope for design or the display of taste—the other, that of being not only permitted but encouraged to treat the subject *con amore,* and to satisfy oneself. To talk of an architect's being left to satisfy himself—though some, by-the-bye, seem to be very easily satisfied with themselves—may sound strangely to those who look upon him as little better than a tradesman—not as a professional adviser in art, but a sort of apothecary, who has merely to make up their own prescriptions; nevertheless, it is so essential an architect should have such liberty granted to him, that he who shows himself indifferent to it, almost forfeits the name of artist, showing himself to be little better than a mere hireling. Of course, this is to be understood *grano salis,* according to the circumstances and importance of the case; neither is it to be supposed that employers and their wishes are to stand for nothing in the matter, as if it were of very little moment, whether they were satisfied or not. Let employers explain their ideas, and urge their own particular views, but let them also listen patiently to those of the artist himself, otherwise they show either that they more than doubt his capacity, or that they shrink from listening to arguments that may convict them of ignorance or of obstinacy. Architects themselves, on the other hand, might sometimes profit by the hints and remarks of their employers, and should feel rather inspirited—certainly not discouraged, when they find their designs strictly scrutinized, instead of all their merits being detected at a glance; in which latter case it may be presumed the merits are rather superficial and not very numerous. Excellently well it is observed by Chateauneuf: "undoubtedly it is very pleasant to an architect to meet with an employer disposed to give him *carte-blanche* and permission to follow out his own ideas unrestrictedly; yet it is still more delightful to meet with one, who instead of merely passively acquiescing, assents from conviction, after deliberate study of the ideas submitted to him, and from the lively interest he takes in them."

III. Whatever the *Pecksniff's* may think of the matter, certain it is, that though the more obvious features of a style may be copied mechanically by any one, to give the true and the better spirit of the style itself requires an earnest study of it, and a kind of study which instead of being to be got out of books, must be brought to them. That such should be the case is rather consolatory than otherwise, since it proves architecture to have some pretensions to rank as a fine art, not only in regard to the works it produces, but to the mode in which it works. In architecture, very much depends upon conventional forms, and conventional as well as mechanical rules: yet though indispensable in themselves, rules are of little more than negative value: they instruct us to do just that which they can teach any one else to do equally well—and no more. They bring us up to the point where the many stick fast, and beyond which only the few can pass who possess within themselves that finer instinct called genius or talent. Though such opinion may appear somewhat paradoxical, by no means does it follow that a building or design which exhibits the more direct and standard features of the style it professes to be in, gives us the spirit of the style itself; for instead of doing so at all, it may fail to manifest any of its better qualities, and of its latent powers may indicate nothing. Mere correctness and no more, is not much matter for boasting of, the merit attending it, whatever it may be in itself, being but a second-hand one. Much less is it any merit to be correct only in parts—in the commonplace features of the style professed to be followed, while everything else is all but in direct variance with it.

IV. Professor Cockerell has been denounced by Professor Pugin as the man "*wot*" paganizes in the universities, but there was another paganizing Professor before Cockerell at work in them—at least at Cambridge—namely Wilkins, the author of that mass of architectural mawkishness, ycleped Downing College, as which James Wyatt's design would have been as good. Colleges are not built every day, therefore when an opportunity of the kind does present itself, it should be prized accordingly, and made the most of; yet it is lamentable to perceive how often some of the best opportunities have been converted into mere jobs. King's College in the Strand is such an arrant architectural nullity, that its insignificance in that respect shields it from criticism, no one considering it worth while to animadvert upon or even mention so miserable a piece of design.

V. Much as it is the fashion to talk about style and styles, we generally content ourselves with their mere *rincings out*—with sadly deluted, sickly watery stuff, that has neither flavour nor body in it. Of such quality is most of our modern Anglo-Grecian, and our recent Early English. The original spirit is so weakened and rendered so "wishy-washy" by the insipidity poured into it, as to be scarcely perceptible. Yet such dilutions of style are palmed upon us as being quite pure and unadulterated, although they are so only inasmuch as no other spirit or flavour of any kind has been infused into the style nominally adopted; the consequence of which is that we get only the purity of pure insipidity.

BAVARIA.—MUNICH.—THE POMPEIAN HOUSE.—We mentioned in our last the project of the King to erect a Pompeian House near his residence of Aschaffenburg. This plan advances towards realization; the director of buildings, Von Gartner, is instructed to employ the drawings brought by Professor Zahn from Pompeii in 1839, for its construction. It was in this house that the beautiful painting on the walls was found, representing Achilles found by Ulysses among the daughters of Lycomedes; also the groups of fauns and bacchantes, on a blue ground; Hypolitus and Phædra, Ceres, Hygeia, Venus, and Adonis. All these will be carefully copied for the Pompeian House at Aschaffenburg, with the rich bronze altars, marbles, and inscriptions found in the house of Castor and Pollux; so that the visitor will find himself completely in the *domus* of an ancient Pompeian.

ARCHITECTURAL DRAWINGS, ROYAL ACADEMY.

A change has taken place this season in regard to the Architectural Room, inasmuch as it has been removed to the "opposite side of the way," that is, instead of being on the right, it is now the one on the left hand of the staircase; but as both rooms are of precisely the same size, nothing is gained by the change, in point of increased accommodation, and in other respects matters continue nearly *in statu quo;* for we perceive no improvement whatever in the system of hanging the drawings, of which we have said so much on former occasions, that we are sick of the subject. Neither is there, we are sorry to be obliged to say, any improvement at all in the general character of this part of the exhibition—rather quite the reverse—an obvious falling off; and however it may be regretted, this will hardly be wondered at when we find that a very great proportion of those who have hitherto generally contributed to the attractions of the Architectural Room, have this year sent nothing.

The architects want old Soane among them again, to give them a fillip, for as to the present Professor of Architecture at the Academy, the walls might exhibit a blank, it seems, for aught he cares. There was not a single design or drawing of any kind of his last season; and it is just the same now. We do not say that this is very greatly to be lamented in itself, but it is rather lamentable to find that his example is now contagious. It has been followed by Barry, Basevi, Blore, Burton, Donaldson, Ferrey, Poynter, Salvin, S. Smirke, Tite, Wild, and many others whose names do not immediately occur to us. There is very little to inform us what has lately been done, or what is either actually in progress or about to be commenced. Among other things of the kind we had reckoned with some confidence upon seeing the design for the new Conservative Clubhouse, by Basevi and S. Smirke, nor is that by any means our only or chief disappointment, there being, among many others, the new Chapel Royal at Buckingham Palace, which we are bound to suppose well worth seeing. We should like, too, to have found the design for the façade of the British Museum, which we are told is on the eve of being at length commenced;—how we should like the design itself is a different matter—we suspect, not very much; yet, at all events, Sir Robert Smirke has had ample time for studying it, and improving upon his first ideas; nor can he very well fail to be aware that architectural taste has undergone some change for the better within the last twenty or five and twenty years, and that consequently his once admired "classical purity" is not likely to be at all relished—perhaps hardly endured now, but be in very great danger of being voted dull, frigid, and stale common-place. Sir Robert Smirke may be quite as able as ever he was—a rather ambiguous compliment, by the bye—but that wont suffice: what was talent yesterday, is not always looked upon as such to-day: if he has been standing still all the while, others have not; and even the public have now got a-head of him. Most numerous and ample have been the opportunities afforded him during his career—quite equal, with one exception, to Barry's; but he has frittered them all away; and instead of making, as the latter has done, architectural gems out of small buildings—the Traveller's Clubhouse, [1] for instance—he has made large ones, very little in manner, and exceeding meagre in taste. This, however, is a sort of *par parenthèse,* which our readers are at liberty to skip, and we therefore go on to say that, on the other hand, there are a great many subjects in the present exhibition that we could very well have dispensed with altogether, they being terribly stale, and withal, most unattractive as drawings. Who cares to look at a frame filled with such nothingness as a parcel of Corinthian columns, merely because they are called "The Temple of Jupiter Olympius"?—or at an architectural *bulletin* informing us what was the exact state of the "Erechtheum" last summer? What pretensions, again, have such things as mere architectural portraits—views of buildings in the metropolis, and those tolerably well known—to be admitted into what professes to be an exhibition of original productions, and which, if not strictly confined to them, ought at least to give us only unedited subjects? Exceptions might, perhaps, be allowed in particular cases, where a building that has never been satisfactorily represented before, receives for the first time the attention it merits, and the want of positive novelty in the subject is amply made up for by tastefulness of execution as well as mere fidelity of likeness. This, however, is by no means the case with such things as No. 1187, "Perspective View of St. Pancras Church," or No. 1284, 'Interior of St. Martin's in the Fields." If we cannot have what is much fresher and better, far rather would we meet here again with some of the works that have delighted us on former occasions, and to renew acquaintance with which would be refreshening. So impossible is it to discover any sort of system in the management of the architectural part of the Academy's exhibitions, that we fairly conclude there is no system at all, but that the whole is left to "Providence" and the porters. That St. Peter is not one of them, is evident enough, for had he the keys of the architectural room in his keeping, hardly would he admit such architectural Balaam and rubbish as we have seen here hung up; not this season more particularly, but more or less every season. It would seem that any thing in a frame and glass will pass muster so long as room can be found for it, or it serves to fill up an obstinate gap into which no other sized frame can be fitted:—which is by no means a very *fitting* practice in itself; at any rate we would rather encounter a few blanks on the walls, than such prizes. It is really grevious to observe some of the *Pecksniff* things that are permitted to show themselves at the Academy, and there stare us full in the face, unless good luck has so well managed both for them and for us, that they happen to be put out of sight. We could mention more than one or even two specimens of the kind in the present exhibition, but the authors of them would hardly thank us for calling attention to them, or feel flattered by coming in for such share of our notice. It is possible that some of the productions of this stamp may be in themselves meritorious, since they may be the works of mere tyros—the first essays of "tender juveniles," who have just learnt to make use of pencil and compasses; but then schoolboy exercises should be kept at home for home admiration, and not publicly paraded, at the risk of being pelted at.

What seems not least of all strange to us is, that there should uniformly be so many things, which professing to be mere designs or ideas, show themselves so barren of ideas—so devoid of any originality either as to conception or treatment. In such cases, it is to be presumed, a design is intended as a display of talent, and to manifest what its author is capable of doing, provided opportunity be afforded him. To produce things of that kind merely to show average taste, and what, if quite as good, is not at all better or more striking than what has been done again and again before, and may be seen almost anywhere, is hardly worth while: nevertheless, we find that it is often done, for be the drawings themselves ever so satisfactory as such, there is very little thinking put into them. Of that description, however, there are very few designs this season—very little in the shape of *Projects*, or what professes to be merely ideal.

Except that it is upon the whole less striking and attractive than usual, it is difficult to say what is the character of the present exhibition, or what class of designs predominate in it. Scarcely ever, indeed, is it possible to form any such general conclusions, or to judge which is the style in particular that seems to be best treated; and this is in no small degree owing to the very great diversity of manner in execution, and the degree of ability displayed in it; for while in some instances things that are rather of mediocre quality in themselves are rendered striking by the taste or spirit with which they are represented, others which are superior as designs, or at least contain superior ideas, are so indifferent as mere drawings as to seem altogether insignificant, more especially when seen along with others, and hastily judged of by the "first sight" impression they make upon the eye. So far, then, an exhibition room is not the very best place of all for forming impartial comparisons, and for judging of the intrinsic architectural merits of the different designs. In order to do that, it would in fact be requisite that they should be all upon the same scale or very nearly so, all in the same style as to drawing and colouring, and moreover, what is not the least important matter, that they should all be to be seen equally distinctly. This last, it must be admitted, is almost an impossibility, since, in order to be so seen, they must all be hung upon the same level, that is, just upon the "*line*," and that line would require to be a very "*long yarn*"—about as long as the front of the National Gallery itself, to accommodate the number of subjects we here meet with. Still some little more judgment, or common sense might be exercised than is done at present; and if the suitable accommodation for them cannot be obtained in proportion to the number of drawings, this last ought to be reduced so as to correspond in some degree, with the accommodation.

Of either Grecian or Roman design there is this year very little, though there is at least one of great merit, and all the more welcome because intended for execution, viz. No. 1290, "Interior of St. George's Hall, Liverpool," J. L. Elmes. It is indeed a most noble specimen of Greco-Roman interior architecture, beautifully imagined in its general composition and arrangement, and tasteful and well

[1] Speaking of this small but certainly not least work of Barry's, the *Polytechnic Review* says, "A chaste specimen of the Italian style, the more it is examined the more it becomes the subject of admiration, and to some almost of adoration. Barry has had the good fortune to have this monument described by the pen of one of the first architectural critics, by one who is no less qualified for any task by the extent of his knowledge than the soundness of his judgment, and who has perhaps done more by his writings for the promotion of sound architectural principles than most men have by their works."

studied in its details, so as to be perfectly homogeneous in character, and to combine sober grandeur with richness, and with a far more than ordinary degree of picturesqueness and scenic effect also. The design, moreover, engages entirely by its own merits, for though carefully and ably executed, the drawing itself is not at all striking or showy, and has not even the ordinary allurement of colour to attract the eye to it. Not always is it that a public structure which is of imposing architectural character externally, presents a corresponding one within; but in this instance the whole will be of a piece, and not only as regards the degree of effect, but also the species of it. In this Corinthian hall, not only is the style of the exterior kept up in regard to the order and decoration, but also in regard to what is a happy novelty in itself, namely, the closing up the lower part of the intercolumns with ornamental screen walls.

Of Grecian design we have another specimen in Nos. 1162 and 1322, the former being "A south-west view of the mansion now erecting at Silverton Park, Devonshire, for the Earl of Egremont," the other of the "Central hall in it," by J. T. Knowles. The first, being placed over a door, is unfortunately too high to allow us to see more than its general composition; for though the drawing itself is of considerable size, the architectural scale is but moderate. Speaking of the mansion, in the last No. of the *Gardener's Magazine*, Mr. Loudon says, "it is eminently classical, abounding in colonnades and porticos without a single vulgar feature externally;" and that there are colonnades and porticos we can plainly see, but that it is therefore "eminently classical" we will not decide, because we cannot make out the other features very distinctly, nor can we judge at all of the quality of the detail. The interior, Mr. L. informs us, he had not an opportunity of seeing, and so far we have the advantage over him in some degree, being here shown what is, no doubt, the most striking part of the interior—perhaps is made rather more so than it ought to be. This "Hall" is carried up the height of two floors, and on the level of the upper one has a peristyle of Corinthian columns. Taken by itself this arrangement is effective enough, though not particularly novel; but we are of opinion that the general design would have been more classical had the lower order in pilasters been omitted. We do not approve of the introduction of two orders, particularly of two such distinct ones as Doric and Corinthian, in interior composition. To us it generally seems to destroy that degree of unity which we naturally look for in an apartment, and to cause its sides to appear too much like external elevations. We think, too, that in the present instance the Doric pilasters carry with them an air of plainness that contrasts rather harshly with the richly decorated and painted ceiling. The best excuse, perhaps, for the introduction of them is, that they serve to divide the walls on which the upper gallery rests, into compartments, each of which is occupied by a large figure on its pedestal (ten of them in all, or five on each side). Though decoration has not been spared, it strikes us that there is a certain poverty of feeling and poverty of form—perhaps owing to the endeavour to obtain simplicity, in some of the separate parts; the doors, for instance, would have borne to be made more important and richer features.

One of the principal subjects in the Grecian style is No. 1197, "Design for an alteration of the National Gallery by effecting, at a small outlay a more imposing elevation."—D. Mocatta. The "small outlay" is somewhat questionable, nor is the alteration here suggested so satisfactory, upon the whole, as it might have been rendered by the outlay of a little—by which we mean a good deal more study upon it; still we think it would produce a decided improvement with regard to the portico and centre of the façade, bestowing on that part of the composition greater loftiness and also greater importance in other respects, though the dome is removed; but that is a feature that can very well be spared, because while it contributes scarcely at all to give the front any dignity in regard to height, it is in itself as insignificant as it is tasteless. In order to increase the altitude of the portico, the columns are here elevated upon a podium added to the present stylobate, by which means their capitals are raised to the same level as the cornice now is, so that the entablature of the octastyle would clear that of the rest of the front. Thus the centre would be more conspicuously marked in the general outline, and the pitch of the pediment being somewhat increased, and bold acroteria and groups of sculpture being placed above it, the augmentation as to height would be considerable, at least as far as effect is concerned. Besides the embellishment just mentioned, the pediment itself is filled with sculpture; and it would, in our opinion, be a further improvement were some enrichment of the kind bestowed on the podium on which the columns are raised; for while it would give the portico a very unusual and here most appropriate degree of richness, sculpture in that situation would show itself to very great advantage, and would serve to give importance and finish to the plain wall or stylobate below the portico, to which it would become an ornamental crowning frieze. Another very considerable alteration here proposed, as regards the portico, is the covering in the ascent up to it on each side, by carrying the steps behind columns so placed as to form wings or loggias immediately attached to the centre octastyle, but retiring the space of an intercolumn. Thus the whole of the centre, if not exactly the portico itself, would thus be greatly extended in breadth, and be rendered a picturesque piece of *polystylar* composition. So far we are very well satisfied with Mr. Mocatta's suggestions, but in his alterations of the rest of the façade he has been by no means so happy. Instead of being at all improved, the windows are made little better than bare apertures, therefore, instead of contributing at all to beauty, tend rather to impoverish and impair the general effect. Of this design we have spoken somewhat minutely, because it possesses, for ourselves at least, an interest of a peculiar kind, being not merely a work of fancy, but an attempt to correct a rather important public building which is now very unsatisfactory in many respects. What is good in Mr. M.'s project seems worth consideration; we should, therefore, like to see a model of the centre compartment on an enlarged scale.

Besides the subjects we have mentioned, there are scarcely any in the Grecian style, and not very many in the Italian; for Gothic of various kinds, Tudor and Elizabethan, greatly preponderate, and of designs for churches, mansions, almshouses, &c., in those styles we find more than the average compliment: and among those for churches are several interiors, one of the most striking of which is No. 1185, "Design for the restoration of the Church of the Holy Trinity, Hull," T. Allom. As may be supposed, the subject loses nothing of its interest by being treated by so able a pencl as that of Mr. A., but it is also an attractive one in itself, and of a character likely to be considered most horribly extravagant by "Church Commissioners." Not knowing what the structure actually is in its present state, we are unable to say what is and what is not the work of restoration; we presume, however, that the fittings-up—pulpit, seats, &c., are entirely so, and they are of a superior kind.

On looking over the catalogue again, and seeing how many names there are of designs for churches, we almost reproach ourselves for negligence in having marked so very few for notice of any kind—either for approbation or the contrary; yet such being the case, it is evident that unless put out of sight, the productions of that class did not strike us as possessing in general more than negative merit—that of being not bad, without being positively good, at least not in regard to any fresh ideas. No. 1247, "Interior of the church about to be erected at Whitstable, Kent," R. C. Carpenter, is of better character than ordinary, plain, but neither impoverished nor tame; on the contrary, marked by considerable vigour of style, and by much pleasing expression. No. 1274, "Design for a church in the Norman style," Gough and Roumieu, shows some fancy, and as represented in the drawing, is a more picturesque composition than usual. No. 1317, "Interior of the Cemetery Chapel erecting at Cambridge," E. B. Lamb, is, though small as a structure, of very superior quality as a design, and is, withal, characteristic of its purpose. Excepting the painted window and the inlaid pavement there is little of actual decoration. Although few, the features are so well marked, so well put together and contrasted, as to give value to each other, and produce a degree of artistic effect, that we could wish to find much more frequently than we do where the means for obtaining it seem to have been far more liberally afforded. This design furnishes an excellent idea for a small private or domestic chapel in the same style.

(To be continued.)

Sinking of the Caspian Sea.—A communication was lately received at the Academy of Sciences from M. Hommaire-Dehel, on the difference of the level between the Caspian sea and the sea of Azoff. Several scientific men have been charged by the Russian government to ascertain the level between these two seas; but the results have differed so much that a verification was necessary, and this was undertaken by M. Hommaire-Dehel, in 1838; but it was not until September, 1839, that he could establish his points of survey. M. Hommaire-Dehel now reports that 18·30 metres is the difference of level between both seas. It results, from the observations made by M. Hommaire-Dehel on the shores of the three seas of southern Russia, at the mouths of the different rivers and streams in the steppes of Astracan, and at the sea of Azoff, that the Caspian sea had formerly a much higher level, and that it was united with the Black sea at a period anterior to any existing historical records. Already this idea as to the junction of the two seas has been maintained, but it was said that the Black sea had become lower by piercing its way through the Bosphorus, and shedding its waters into the sea of Marmora. The sinking of the Caspian sea has been accounted for by the lowering of the basin, but M. Hommaire-Dehel gives an explanation of this, which he conceives more natural, by observing that the Caspian sea has very few tributaries, and that a diminution in the waters of the Oural and the Volga has been a sufficient cause for the lowering of the level of this sea.

ON THE PERFECT VENTILATION OF LAMP BURNERS.

In consequence of the injury sustained by the books in the library at the Athenæum Club, amounting almost to the entire destruction of the bindings; and the complaints of the members of the vitiated state of the air in the rooms, causing headache, oppressive breathing, and other unpleasant sensations; Professor Faraday's attention as a member of the club, was drawn to the subject of ventilating lamp burners in houses; and he was induced to suggest the trial of various plans for affecting the removal of the products of combustion, produced by sources of artificial light. All substances used for the purpose of illumination, may be represented by oil and coal gas; although tallow and wax are also greatly employed, yet as until they are rendered fluid like oil, they cannot be burnt, they may for all practical purposes be classed with it. Now, oil and gas both contain carbon and hydrogen, and it is by the combination of these elements with the oxygen of the air, that the light is evolved. The carbon produces carbonic acid, which is deleterious in its nature, and oppressive in its action in closed apartments, and the hydrogen produces water. A pound of oil contains about 0·12 of a pound of hydrogen, 0·78 of carbon, and 0·1 of oxygen; when burnt it produces 1·06 of water, and 2·86 of carbonic acid, and the oxygen it takes from the atmosphere is equal to that contained in 13·27 cubic feet of air. A pound of London coal gas contains, on an average, 0·3 of hydrogen, and 0·7 of carbon; produces when burnt, 2·7 of water, and 2·56 of carbonic acid gas; consumes 4·26 cubic feet of oxygen, equal to the quantity contained in 19·3 cubical feet of air. So a pint of oil, when burnt, produces a pint and a quarter of water; and a pound of gas produces above 2½ pounds of water; the increase of weight being due to the absorption of oxygen from the atmosphere, one part of hydrogen taking eight by weight of oxygen, to form water. A London Argand gas lamp, in a closed shop window, will produce in four hours, two pints and a half of water, to condense or not, upon the glass or the goods, as it may according to other circumstances happen. Also, a pound of oil produces nearly three pounds of carbonic acid, and a pound of gas, two and a half pounds of carbonic acid. Now carbonic acid is a deadly poison, an atmosphere containing even one-tenth of it, is soon fatal to animal life. The various accidents from lime and brick kilns, from brewers' vats, occasionally from the sinking of wells, as at Cheltenham, and from the choke damp in coal mines, attest the extreme danger contingent upon the presence of this substance. A man breathing in an atmosphere containing 7 or 8 parts of carbonic acid, would suffer, not from any deficiency of oxygen, but from the deleterious action of the carbonic acid. M. Leblanc has recently analysed carefully the confined air of inhabited places, and concludes, as stated in his *Memoire*, that the proportion of carbonic acid gas in such places, may be regarded as measuring with sufficient exactness, the insalubrity of the air; that in the proportion of one part to a hundred of air, ventilation is indispensable for the prevention of injury to the health; that the proportion of carbonic acid gas had better not exceed a five hundredth part, though it may rise without inconvenience, to a two-hundredth part. If a lighted taper be applied to the top of a lamp chimney, it will be instantly extinguished, or a glass jar held over it will become immediately filled with air, in which a light cannot burn. Also sulphurous and sulphuric acid, are contained in the water which results from the combustion of coal gas, and are products injurious to metals and articles of furniture.

It will now be understood, that the object sought to be attained in the ventilation of lamp burners, is the entire removal of all the noxious products of combustion. And with this view, at Professor Faraday's suggestion, the gas lights of the chandelier in the library at the Athenæum, were ventilated by pipes dipping into the lamp glasses, and conjoining at a short distance upwards into one central pipe, which carried away all the burnt air out of the room. In this first practical experiment, many things were learned as to the mode of arranging the pipes; the disposal, when the pipes were very long, of the water produced, &c.; but the objects sought for by the ventilation, were at once and perfectly obtained. This principle may be illustrated by a simple experiment, showing the difference between allowing combustion to give its products to the air of a room, and carrying off these products as soon as formed to the exterior, let a short wax candle be placed burning on a plate, a glass jar put over it, and the upper aperture of the jar closed by a globular cork, through which passes a piece of glass tube, about half an inch in diameter, and twelve or fourteen inches long; the tube descending to the top of the candle flame, and being placed just above it. Under these circumstances there will be plenty of air passing into the jar, between it and the plate, and out by the tube, to supply all that is needed for combustion, and keep the glass chamber sweet; the consequence is, that in this position it will go on burning for any length of time, and the jar remain quite clear and bright; but on moving the cork a little, so that the tube shall no longer be over the flame; all these results will change, though the air way remains exactly as before. The candle will now give the products of its combustion to the general air of the glass chamber, the glass will immediately become dull, from water deposited upon it, the air itself will become worse and worse; the light become dim, and in a few minutes will go out. But if arrested from doing so by the tube being again placed over it, signs of recovering will appear, the light will return to its former brightness, and after a short time, even the dew will disappear from the glass; all in consequence of the proper ventilation of the light. These effects, though striking, may easily be understood by any one who will think of the difference of lighting a fire in the middle of a room, instead of under, or in right juxtaposition to a chimney.

Then came the desire of modifying the system, by removing the ascending flue from its place over the lamp, not from any deficiency in action, but for appearance sake only; and finding that there was sufficient ascension power in the main part of the metal chimney, to allow of a descending draught over the lamp, the tube, in place of going directly upwards, was made to turn short over the edge of the glass, to descend to the area or bracket, to pass along it, and then ascend at the central part of the chandelier, or against the wall if applied to a single light. To this succeeded another form, which is exceedingly beautiful, and appears to be the perfection of lamp ventilation. It is in fact, a beautiful application of the principle of a descending draught to a lamp burner. The gas-light has its glass chimney as usual, but the glass holder is so constructed as to sustain not merely the chimney, but an outer cylinder of glass, larger and taller than the first; the glass holder has an aperture in it, connected

Fig. 1. Fig. 2.

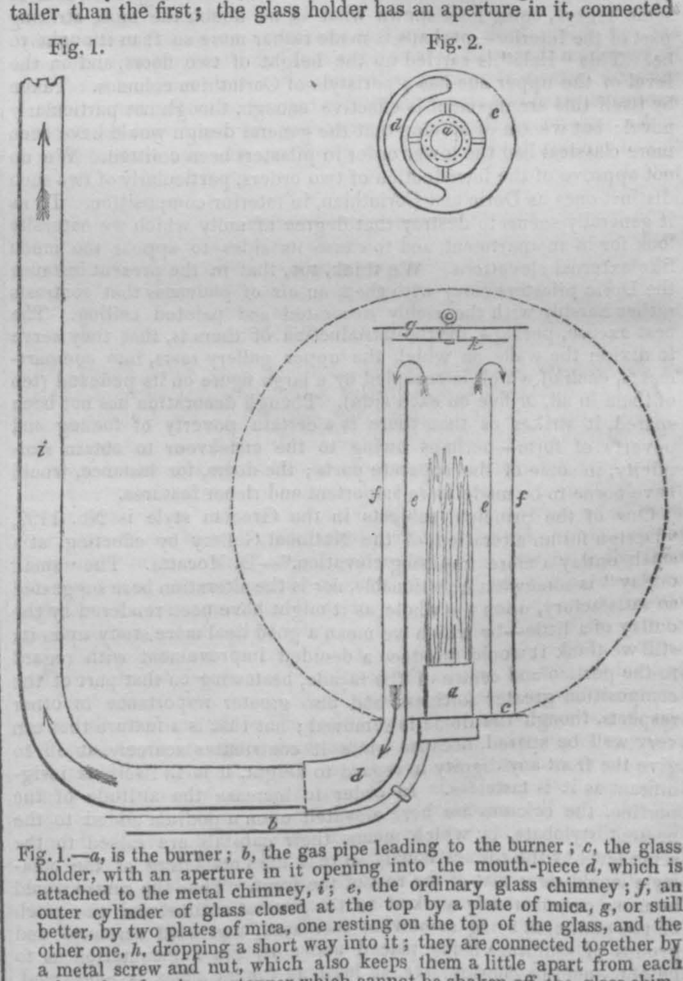


Fig. 1.—*a*, is the burner; *b*, the gas pipe leading to the burner; *c*, the glass holder, with an aperture in it opening into the mouth-piece *d*, which is attached to the metal chimney, *i*; *e*, the ordinary glass chimney; *f*, an outer cylinder of glass closed at the top by a plate of mica, *g*, or still better, by two plates of mica, one resting on the top of the glass, and the other one, *h*, dropping a short way into it; they are connected together by a metal screw and nut, which also keeps them a little apart from each other, thus forming a stopper which cannot be shaken off the glass chimney, but is easily lifted on and off by the small metal ring or knob at the top; *i*, is the metallic tube chimney; *k*, a ground globe, which may be applied to the lamp, and which has no opening except the hole at the bottom, where it rests on the glass holder; but any other form, as a lotus glass or a vase, may be substituted at pleasure.

Fig. 2, is a plan of the glass holder, showing the burner, *a*, in the centre, perforated with jets, with openings round it to allow of a free admission of air to the flame, and the aperture *d*, which opens into the mouth-piece, connected with the metal chimney, *i*.

by a mouth-piece with a metal tube which serves as a ventilating flue, and which after passing horizontally to the centre of the chandelier, there ascends to produce draughts and carry off the burnt air.

The burnt air and results of combustion, take the course indicated by the arrows, and are entirely carried away by the chimney. Now with a lamp burning in the ordinary way, the products of combustion issue out as a torrent of aerial impurity from above, but if the above arrangement be applied, on closing the top of the outer glass cylinder by a plate of mica, all the soot, water, carbonic acid, sulphurous and sulphuric acid, and a portion of the heat, are entirely carried away by the aerial sewerage, and discharged into a chimney or the open air, and the air in rooms may thus be kept in the same sweet and wholesome condition, and fit for the purposes of respiration, as if artificial light were not being used.

A curious but important result of the enclosed lamp, is the increase of light produced, amounting to from 10 to 20 per cent, according to circumstances, the same quantity of gas being consumed as before. If the current of air through a lamp glass, when the gas is burning in the usual manner, be diminished, the flame rises in height, and the light is increased in amount, but is of a redder colour; the combustion in fact is not so intense, because the access of air is retarded; the particles of carbon which give the light, are not so highly ignited, but are more abundant, and are ignited for *a longer time*, thereby causing an increase of light.

The advantages of the above plan are many; it is not in the least objectionable in architectural appearance, the ventilation is perfect, the heat given to a room is modified and pleasant, and may be either sustained or diminished at pleasure; the light, for good philosophical reasons, is increased considerably for a given portion of gas, and increased safety from accidents is obtained; as in the event of any leakage from the pipes, or from a gas cock being inadvertently left open, the gas, instead of mixing with the air of the room, and becoming explosive, would be almost inevitably carried off by the metal tubes.

We understand that Professor Faraday has transferred his right to this invention, to his brother, a gas-fitter, who has secured it by a patent.

REVIEWS.

MODEL DRAWING.

A Manual for Teaching Model Drawing from Solid Forms. By Butler Williams, C.E., Director of the Drawing Classes at Exeter Hall, Professor, &c. Under the sanction of the Committee of Council on Education. London: Parker, 1843.

We have before had frequently to advert to the subject of instruction in design, feeling that we had a double responsibility imposed upon us by our two classes of professional readers; in the first place to advocate the necessity of the proper instruction of workmen, in the next place to watch the interests of art. The want of instructed workmen is a great inconvenience to the professional man—a great obstacle often to the proper execution of his plans, and a knowledge of drawing is essentially requisite in order to enable the mechanic or artizan adequately to execute the designs of his employer. The general progress of art and the creation of a true and sound taste for art, are indissolubly connected with the advancement of architecture and its due appreciation. What is the good of the architect throwing pearls to swine, what stimulus can he have to his exertions from the applause or censure of an ignorant or tasteless mob? The painter, the sculptor, execute their small works for the pleasure of a single individual, or the inspection of a restricted number of visitors; but the architect is called upon to erect monuments which are the delight or disgust of millions. For one man who sees the Loggie or the Sistine chapel, ten see St. Peter's; for one who has the happiness to see Barry's Adelphi pictures, thousands and tens of thousands daily contemplate St. Paul's. The architect, then, has perhaps more at his disposal the means of elevating public taste, than the painter, the sculptor, or even the engraver; it is his to convey those general impressions of art, and that catholic love for it, which the painter and the sculptor are to profit from in their more detailed works. Can we imagine a people living amid the glories of the Parthenon and the other wondrous works of Athenian architecture, without acquiring a deeply rooted sympathy for art—can we suppose men living in sight of the luxuriant monuments of the middle ages, without manifesting a love for beauty of form in every object? We know they did not; we know that the Athenian city, which Pericles built, cultivated every branch of art—we recognize, in the commonest relics of the middle ages, the labours of the artist. When one department of literature is at its height, you have a general proficiency, when one department of art, a stimulus is given to other pursuits. When we had a Shakspeare, then had we Spenser, Jonson, Sidney and Drayton—when Milton, Dryden, Butler, and Denham—when Pope, De Foe, Addison, Swift, and Steele. There is an excitement in a multitude, there is a stimulus in a crowded amphitheatre, which brings out the greatest efforts of the mind; and if you wish literature, if you wish art, if you wish science to flourish, you must not seek to nourish one branch, but to give the greatest scope to all. We therefore cannot pass over in silence anything which so nearly concerns the general interests of art, as the education of the people in design, and the more so at the present period, when an endeavour is at last being made to establish drawing as an indispensable branch of primary instruction.

The work before us is under the authority of the Committee of Council on Education, and published as a text book, which all the schools under their control are to adopt as a normal rule for their guidance. It is drawn up by Professor Butler Williams, C.E., the Director of the Normal Drawing Classes, and describes the course followed in them. It would consequently be well worthy of our examination, if it were only to assure ourselves that the artistic instruction of the country would be properly conducted, but it becomes imperatively necessary to do so, when principles are introduced which appear pregnant with danger to the prosperity and progress of art. With Professor Williams individually, we have on this occasion nothing to do; he seems to have executed the task assigned to him, ably, honestly, and zealously; we shall therefore direct our attention to the system of which he is the expositor.

Among the ancients, drawing was carefully cultivated among workmen, and if we wish to see how extensively and how successfully, we find abundant examples in the unfinished and the complete specimens of the clay vase. Certain it is that the potter of the modern day, is as inferior to his Greek predecessor in artistic proficiency, as perhaps he may be superior in mechanical skill. The use of drawing too was widely spread among the people at large, because among a people uninstructed in writing, delineation becomes both an amusement and a necessity. The Polynesian thus records memorable events, decorates his war-boat, his weapons and his hut, and amuses himself and his comrades with caricatures on the topics of the day. Thus it must be, even among people more advanced in civilization, while unlettered; and if it were on account of the caricature only, design would be resorted to. The numerous examples of this to be found in ancient history, and on the monuments of the people, show how general was the practice of drawing, and what a strong hold it had among the people. We trace this also in the middle ages; we see grotesque sculptures even in sacred edifices; we find satire lurking often in the missal, and we know that commotions were often as much excited by the rude delineations of a Cola di Rienzi, as by the eloquence of a popular orator. Perhaps the general spread of letters no less shook the lower and more popular use of art, than did the Reformation strike mortally at its higher efforts. The player, the ballad-singer, and the news-monger, strove successfully for the annihilation of rustic art, and the grim visages on the corbels, and the rude chalkings on the wall, lost their wonted charm, and with them much of the love of art and of its practice. Certain it is that in the middle ages, art entered more into the pursuits of life than it did subsequently, and into the labours of every artisan. Clothes, weapons, furniture, were more elaborately decorated than they have since been, or than the simpler habits of modern times will ever allow them again to become. It was to this proficiency on the part of the workman, that the mediæval architect was indebted, for the luxuriant finish given to his design, and the rich profusion of ornament which sustained the character of the general conception. How rare, how difficult, has it been in those days, to be able to follow in his step; the machine is the only means of enabling us to imitate at humble distance this luxury of the past. The revival of architecture in England by Wren made this want to be strongly felt, and the establishment of a school of design by Mr. Baptist Lens, as detailed in our *Journal*, (Vol. V, p. 53,) was the consequence. From that time little progress was made until our inferiority to foreign nations and our economical loss, became so painfully manifest as to induce the establishment of schools of design throughout the country. With regard to the Royal School of Design at Somerset House, it was our duty early to point out the gross and lamentable errors in the system of instruction. We then pointed out the danger of copying from drawings, and the necessity of a greater attention to figure and ornament, if we wished to make the establishment useful to the country or the people capable of competing with their foreign rivals. These views of ours and of those who coincided in them, met with the strongest opposition from the Directors of the School, and from artists, and but little attention from the public. They have, however, finally prevailed, and the result is that in the general system of elementary instruction in drawing, propounded by Professor Butler Williams on the part of the government, the error of copying from drawings is strongly reprobated, and is excluded from the plan. The Professor says:

Drawing from Copies.

In the first place we observe, that the pupil is almost universally made to draw from copies.

This fails to exercise the judgment. The drawings which serve as copies, exhibit a symmetrical disposition of lines in true perspective, as also varieties of tint and shadow duly laid and harmonized: they are imitated mechanically by the pupil without his understanding or reflecting upon the means whereby certain effects are produced. His hand alone is exercised; he fails to acquire a habit of observing and seeing correctly, and is unable, after years of labour spent in these purely mechanical exercises, to represent correctly the simplest natural objects. The Chinese cultivate the art of drawing according to this plan; they copy from copies, and produce fac-similies of any work of art; but this is performed solely as a piece of laborious imitation; and their signal failure, when they undertake to design original compositions, is the consequence of the faulty system which aims at training the hand alone to works of the highest skill. High finish in the drawing cannot compensate for glaring inaccuracies of perspective, and even the individual forms, although elaborately brought out, are devoid of expression, exhibiting labour and pains without intelligence, the consequence of following out details without comprehending the scope of the whole design, and of exercising the hand without the guidance of science and understanding.

Drawing from Copies a delusive kind of industry.

Sir Joshua Reynolds, in his Second Discourse, says, "I consider general copying as a delusive kind of industry; the student satisfies himself with the appearance of doing something; he falls into the dangerous habit of imitating without selecting, and labouring without a determinate object: as it requires no effort of the mind, he sleeps over his work; and those powers of invention and disposition, which ought particularly to be called out and put into action, lie torpid and lose their energy for want of exercise. How incapable of producing anything of their own those are who have spent most of their time in making finished copies, is an observation well knowu to all those who are conversant with our art."

Moreover, the drawings presented to the pupil as models, are not always perfect, having themselves probably been copied from other copies, which may also have been made without direct reference to nature. The drawings of all are more or less characterized by mannerism, and thus, a defect in the original imitation is imitated with care by the pupil.

Exclusive, therefore, of a certain mechanical facility of touch, the pupil acquires little real knowledge by drawing from copies. After years of study, he will be capable of making highly-finished fac-similies of engravings or drawings; and, if he be endowed with a retentive memory, he will have learned a set of unvarying conventional signs for the representation of natural objects in their numberless variations.

The reprobated, the discarded system of drawing from copies, well represented as "a delusive kind of industry," was that adopted in the school at Somerset House, and tenaciously clung to by the Council. It was by the practice of this mischievous system that our artizans were to be brought up to compete with the better instructed workmen of the Continent, and our proficiency in those arts and manufactures where design is used, was to be ensured. It has been our good fortune, alone among the press, to have assisted in exploding it, and it is, therefore, with the greater feeling of confidence we approach the subject of model drawing, which is, in our opinion, no less erroneous and mischievous, and in which we shall, perhaps, find equal difficulty at first in producing conviction on the part of its advocates, though we doubt not of success in the end.

The common practice of commencing the system of instruction by copying from drawings, received its first grand assault from the eloquent pen of Rousseau, in his *Emile*, who proposed, as a substitute, that the child should commence by drawing the human figure from the life. This was considered too bold, and the well-known educationist, M. Jacotot, modified it, by suggesting the study of figures from the antique. Neither of these systems, however, had justice done to it, and M. La Croix, among others, suggested drawing from models of the simple forms. This has been carried out by M. Dupuis of Paris, under whose auspices it has sprung up into a recognized mode of instruction, and has served as an example for the Committee on Education here. This system proposes for models, the delineation of the square, the triangle, the circle, the simple geometric figures, and solids and assumes the merit of greater success, of greater accuracy and greater simplicity. Now such a system is likely to gain many converts among those who have prepossessions on the subject, or who have not had practical opportunities of appreciating its relative advantages and defects. It is very well to declaim on this subject, to talk about analysis and synthesis, but the question is of a mental operation and effect, and there, we opine, individual experience and individual imagination can be but of little value. How little by the examination of our own minds have we been able to learn of the mental organization of mankind; how little has the ability and acumen even of a Dugald Stewart been able to effect; and in what a state of uncertainty are the ontological sciences—indeed, what ought to be the highest science is the most unsettled and obscure. This then should teach us the danger of trusting to individual impressions, and induce us to apply to experience, the only proper and trustworthy guide.

Now looking at the matter in every light, we feel ourselves unable to concur with the judgment of those who have adopted the system of model drawing; we are not convinced it is the best, we are not convinced it is the safest. If drawing were like writing, if it were an assemblage of conventional signs, we should be willing to recognise the necessity and utility of an artificial process for its inculcation, but drawing is an art of representation which admits of the least arbitraries, which addresses itself to the representation of nature, and the earliest efforts of which should consequently be directed in the path of future exercise. We cannot understand *à priori*, and the whole of Mr. Butler William's reasoning on this subject is *à priori* —we cannot understand *à priori*, why nature is to be abandoned in the study of drawing; it will be granted that the ultimate end of drawing is to copy nature, why should not its novitiate be so directed. We have not heard of any valid defections to this obvious course; we have no experience of its impracticability, and we think it at least deserved due attention. Not only then do we believe that drawing from nature is the course in which our efforts should be directed, but we have strong grounds for fearing that model drawing is attende dwith serious evils. It is well to say that forms in nature are modelled upon the severe outlines of geometrical figures, but such severity is rarely to be met with in the luxuriance of creation. The inculcation then of conventional forms, must be pregnant with danger. What is the mischief of the system of copying from drawings—that it perverts the eye, and renders the pupil incapable of adequately seeing natural objects? The study, however, of natural objects, is a great means of training the eye and the mind. What can we expect must be the result of putting a child through a preliminary course calculated to dull his appreciation and beauty, but to stunt the artistic faculty, and render him less capable of estimating the beauties of nature? That such will not be the result of model drawing has not been proved; and even if the danger be imaginary, care should at least be taken to ascertain that it is so, and not run unprepared into a career of mischief. We, however, say boldly, and we speak from experience, that there is no difficulty at all in teaching a child to draw from natural objects, and no plea satisfactorily proved to us for putting it through an artificial course. We believe, moreover, that the mechanical system of the committee of council on education, must tend seriously to the injury of the general taste of the nation, and to the consequent jeopardy of the progress of the higher branches of art. At present the nation is uninstructed in art—it is now going to be perverted—and what hope can there be for the development of taste and genius in the mechanical nation, which it is the effect of this system of model drawing to produce? We say, therefore, that on every ground it is well worthy of consideration whether we are to quit the natural method for one not possessing any adequate advantages to compensate for its striking defects. The training of the eye of the pupil, in the first instance, is everything—that is well known—and all that we want is that it shall not have a false bias. To go the full length of recommending at once the study of the living human figure we do not, but we must say, that if an objection exists to the human figure, on the plea of complexity, there are abundance of simple natural objects of still life, particularly in the vegetable kingdom, affording unobjectionable examples. Why the study of a leaf or of a fruit should be less capable of affording correct instruction to the eye than a circle or a square we cannot understand: and sure we are that more interest would attach to the natural object than to the wire or cardboard model. Indeed, Mr. Williams is obliged to confess to the power which natural objects have on the uncultivated mind, though he qualifies his admission by deprecating the greater love of the lower classes for luxuriance than for simplicity of form. We consider the system of model drawing as unjustified by reason and experience; and we think it was at least the duty of the government, with the ample means at their disposal, to have tried sufficient experiments on the comparative merits of the several systems of instruction in design. The system, now adopted, we are strongly of opinion, will turn out like that at the School of Design, productive of great mischief, and characterised as a serious blunder, happy if, as in the case of the School of Design, it be remedied in time.

On Mr. William's book we could have said a good deal, but we have thought it our duty at this length to enter our protest against the mischiefs likely to result from the adoption of the system he propounds, and to which we hope the attention of all who desire the sound progress of art, and the proper education of their countrymen will be directed. In parting, we beg to have it understood that our objection does not extend to the proper application of the system of model drawing, but only to its adoption as the means of teaching design in the first instance. We think that at a subsequent period, as a simple means of teaching practical geometry and the elements of perspective, that it is calculated to be highly useful; but it is to the preliminary use we object, as calculated to blunt the mind, instead of to strengthen it, and with such feeling we call the earnest attention of our readers to it.

Now that we possess the advantage of two competent commissions on national art, namely—the Commissioners of Fine Arts, and the Council of the School of Design, we think it is incumbent on the government to obtain their opinion, before further progress is made with the new system.

Arts, Antiquities and Chronology of Ancient Egypt. By GEORGE H. WATHEN, Architect. London: Longmans, 1843.

EGYPT is a theme so much wrought upon as a staple for book-making, that we have little temptation to take up a new *rechauffée* of the same subject. Relations of discoveries we can read with pleasure, or any masterly attempt to solve the mystery of its ancient history, but Mr. Wathen's book gave little promise from its announcement, and bears little fruit on its perusal. An architect may do much in Egypt for the information of the archeologist and professional man here, and Mr. Wathen, we believe, has ability enough, but instead of giving us any great account of what he saw, the book is a medley formed from the labours of others. First we have a miscellaneous preliminary chapter showing the common relationship of the priests of Memphis, the knights templars, heralds and freemasons, with a considerable portion of the apocryphal MS. purporting to be a conversation between Henry VI. and some freemasons, upon which, as Mr. Wathen has brought it in *à propos* of Egypt, we shall remark that it is a very extraordinary thing that curiosity should have been dormant as to the proceedings of the freemasons from the time of Henry VI. until the end of the 17th century, and that the regal MS. should be brought to light and transmitted for the examination of Locke, in the time of Christopher Wren. *Verbum sat.* The language of this document favours very much the suspicion of forgery, and the legend is so suggestive of doubts, that it would be safest to put it down to the account of some Chatterton of the 17th century, who have never been wanting at any day. That Locke was at all deceived by it is not wonderful, Chatterton and Ireland deceived better antiquaries. The masonic MS. immediately precedes a long article on the chronology of ancient Egypt, in which confusion is worse confounded, and although we have some glimmering that Mr. Wathen is occasionally right in the new views he propounds, he shows himself so illqualified for a guide, that we do not like to trust to his leading. We certainly wish he had left the subject alone. The next section of his book treats of the arts and antiquities of Egypt, and contains full accounts of the principal buildings and monuments, but chiefly derived from other sources. We regret this, as Mr. Wathen shows a power of observation, which might have been usefully employed in preparing a book of his own. This section contains, in defiance of order, a kind of journal of Mr. Wathen's tour in Egypt, which presents many points of interest, and is the only part of the book which he ought to have published. If we thought it worth while to exercise ourselves upon our author's antiquarian dissertations, we could do so to the satisfactory disproof of many of his positions, though not perhaps much to the gratification of our readers. As a specimen how little light the author is qualified to shed upon Egyptian lore, we refer to pages 56 and 176, 226 and 230 of his book. While, however, we thus object to his having put into his book what he could better have supplied with the results of his own observations, we are bound to admit that for those who desire information on Egypt in a compendious form, and particularly as relates to its architecture, a better book than Mr. Wathen's can scarcely be chosen. We extract from his pages the account of Karnak.

Next to the Pyramids the most wonderful relic of Egyptian art is undoubtedly the great Hall of the temple-palace of Karnak. From the inscriptions we learn that it was founded by Menepthah-Osiri I., father of the great Ramses, who was on the throne about the middle of the 15th century B. C. Its superficial area, 341 feet by 164, is sufficiently spacious for a large quadrangle. Majestic in ruin, what must it have been perfect! The massive stone roof is supported by a phalanx of 134 giant columns, ranged in 16 rows. Most of these are 9 feet in diameter and nearly 43 feet high; but those of the central avenue are not less than 11 ft. 6 in. in diameter and 72 ft. high; the diameter of their capitals at their widest spread is 22 ft. The walls, columns, architraves, ceilings—every surface exposed to the eye is overspread with intaglio sculptures—gods, heroes, and hieroglyphics, painted in once vivid colours. It is easy to detail the dimensions of this building, but no description can convey an idea of its sublime effect. What massive grandeur in its vistas of enormous columns! What scenic effects in the gradations of the chiaroscuro and the gleamings of accidental lights athwart the aisles! As you move on, new combinations unfold themselves every moment. Wherever the eye wanders it is filled with picture—rank behind rank, vista beyond vista. Here your eye runs along a pillared avenue and rests upon a vast column at the end, torn from its basis and thrown against the next—now it "is led a wanton chase" through a labyrinth of columns, which from another point fall into regular succession.

The roof is formed of ponderous blocks stretching across the aisles. The three central avenues rise above the general level like the nave of a Gothic cathedral, and the spaces between the upper piers are filled with close-set loopholes. Besides these, the only openings for light appear to have been the great doorways at the ends of the middle avenue and a few slits in the roof of the remote aisles. Thus while a solemn gloom reigned through the interior generally—so grateful to the eye in this land of glare and glitter—the nave was strongly lighted and brought into prominence as a master line bisecting the hall; and a fine gradation of shade, passing off thence into the obscurity of the distant aisles, heightened the effect of the perspectives.

All the resources of Egyptian architecture are here displayed in perfection; —its enormous masses, its long, close files of columns, its deep seclusions, and its rich pervading sculptural decoration. Burke could not have wished for a happier illustration of that part of his theory which refers the sublime in architecture to *succession* and *massiveness*.

The demolition of some of these masses excites even more wonder than their erection. Solid pylons of enormous bulk are broken up or riven in twain. Vast *built* columns seem to have been dragged from their foundations *en masse*. Architraves many tons in weight, wrenched from their place, now impend over the aisles, suspended by yet heavier masses which have perhaps been thus nicely poising them for ages. One might believe they were giants in those days,

"Giants of mighty bone and bold emprise!"

But the Hall of Columns was but a part of this wonderful fabric. Immense pylons, half-buried quadrangles and halls, granite obelisks, and tremendous piles of fallen masonry once formed a range of buildings upwards of 1200 feet in length. The chief entrance was through the gateway of the west front, 63 feet high. Besides these there were other isolated and subordinate buildings. The whole appear to have been separated from the din of the city by an outer peribolus of unburnt brick, inclosing an area about 580 yards in length. A succession of four great propyla led across this area to the side of the chief structure. The outermost, as it was exposed to the view of the city and first received the advancing procession, was the most magnificent. Its length or base line is about 225 feet, its solid width 40 feet; the central gateway is of the granite of Syene. * *

An avenue of colossal sphinxes appears to have been continued from Luqsor up to the outer precinct of Karnak. The few that now remain are mutilated and half interred: but how imposing the effect of such a vista extending nearly a mile and a half over the plain terminated by the great façade of Luqsor! How exactly adapted for the pageantry of processions!

The illustrations, often from the drawings of the author, are of much interest, and we cannot but regret that he has not used his pencil more than his pen.

On the Laying out, Planting, and Managing of Cemeteries, with fifty Engravings. By J. C. LOUDON. London: Longmans, 1843.

THE establishment of Cemeteries throughout the country, must be gratifying to all who take an interest in public decency and public health, while they possess the extrinsic advantage of affording greater scope to art, and contributing to the healthful exercise of the people. The churchyard is an opprobrium in a civilised community, neither harmonizing with the respect due to the dead, or to the care requisite for the living, and the appropriation of eligible places of interment, is a great step towards a better system. Few of our large towns are now without their cemetry, or city of the dead, and the metropolis has the advantage of being girt with many picturesque and interesting establishments of this kind. Starting from Earl's Court, the circle is continued by Kensal Green, Highgate, Abney Park, the Tower Hamlets, Nunhead, and Norwood, each possessing its peculiar beauties and forming an embellishment to the metropolis, of which several of them enjoy views not to be equalled in the world for grandeur or interest. What more fitting abode for the dead, than looking down on the wide-spreading city in which their lives were passed; hovering, as it were, over the scene in which their loved descendants move, and awaiting their presence. How much better is this than the Hades of an Egyptian tomb! With the extension of cemetries, attention has been called to the principles on which they are to be founded, and it has fortunately induced Mr. Loudon to take up the subject. Those who know his accuracy, his minuteness, and his completeness, will be prepared to acknowledge the merit of the present work, which, without wandering into idle and useless details, treats the subject comprehensively, so as to afford every information which is essentially requisite with regard to it. While attending to the professional usefulness of his work. Mr. Loudon, with his usual good feeling, has not failed to call attention to the necessity of any improvements in the mode of interment. He urges most strongly the necessity of no corpse being interred with less than six feet of earth over it, and supports it on every ground of propriety and necessity. He suggests also several improvements as to the mode of laying out cemetries, and remodelling churchyards, and in fine, the reader will peruse his work with interest and instruction.

Ancient Irish Pavement Tiles; with Introductory Remarks. By THOMAS OLDHAM, A.B., F.G.S. Dublin: Robertson.

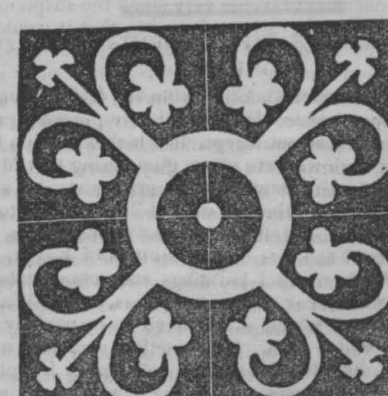
THIS work is of the same value with regard to Irish examples of encaustic tiles, as Mr. Bowyer Nichols' is as to those of England, and shows a laudable desire on the part of the sister country, to draw profit from her antiquarian relics.

The Irish specimens of tile are of three distinct kinds. First, impressed tiles; second, encaustic tiles; and third, tiles in relief. Of the first class, Mr. Oldham states, that the Irish specimens are principally of the ordinary red colour of the clay, the surface being coated with an opaque varnish or glaze, generally of a greenish yellow colour, but occasionally of a dark purplish black, and extending equally over the indented pattern. Although similar examples have been found occasionally in England, in which the hollows were filled with a different substance, removeable by washing, our author observes, that he has seen no such case in Ireland, and thinks it exceedingly improbable that such ever was the case in Irish tiles. In the encaustic variety, the surface is quite smooth and flat, the pattern being produced by a differently coloured substance inlaid. The colours are generally bright red and yellow, or purplish black and pearl grey, and sometimes of purplish black and deep red. The third variety has the pattern formed in low relief. To this latter variety Mr. Oldham assigns the later date, considering it referable to the Tudor times; some of the other examples are however as old as the middle of the twelfth century.

Mr. Oldham mentions some curious facts with regard to the Irish tiles. He says, the identity with English specimens is often recognizable. Thus several of the patterns now remaining at St. Patrick's, Dublin, are nearly identical with some from Malvern, in Worcestershire, and it is of additional interest to find, that about the probable date of these tiles, a connection existed between the two places, for in 1225, the year in which St. Patrick's was made a cathedral, the prior and brethren of Malvern the Less, re-granted to it one half of the tithes of Castleknock, which had been given them in 1221. A kiln, it appears, has been discovered at Malvern, with portions of tiles in the several stages of the progress, and the tiles there used were manufactured on the spot; whence Mr. Oldham conjectures, that some of the Irish tiles were also derived from the same source. The water communication by the Severn and Bristol with Ireland, would favour this idea. Notwithstanding occasional importations, our author is however of opinion that the majority of the Irish tiles were made on the spot.

The following anecdote with regard to the early use of ornamental tiles, is entertaining. The author says:—

But if, on the other hand, our supposition that the pavement tiles at Mellifont were laid down at the time of its erection, (1142—1157) by monks from Normandy, be correct, it would then appear more probable, that the first knowledge of these tiles was derived from thence; and bearing in mind that Mellifont and Bective were both Cistertian establishments; the following notice, obligingly communicated to us by the Rev. Richard Butler, is extremely interesting. In Martini's Thesaurus Anecdotorum, among the "Select statutes of a general chapter of the Cistertian order" is one—"Anno 1210. Let the Abbat of Beaubec (in Normandy) who has for a *long time* allowed his monk to construct, for persons, who do not belong to the order, pavements, which exhibit levity and curiosity, be in slight penance for three days, the last of them on bread and water; and let the monk be recalled before the feast of All Saints, and never again be lent, excepting to persons of our order, with whom, let him not presumeto construct pavements, which do not extend the dignity of the order." These pavements must have been



either mosaics, (tesselated pavements) or tiles; probably, from the manner in which they are described, the latter. In either case, it proves that ornamental pavements had been a long time in use prior to the beginning of the thirteenth century. Nor should the fact be overlooked of the jealousy with which the use of them was sought to be confined to this monastic order.

Of some of the tiles, by the kindness of the author, we are able to give specimens, and we beg to observe, that the work is a valuable contribution to our knowledge of that branch of art.

The Student's Guide to the Practice of Measuring and Valuing Artificer's Work. By a late Eminent Surveyor. London: John Weale, 1843.

To the student this will be found a very useful guide, as far as it goes, but it is not sufficiently extended to be of that benefit the title led us to expect. It does not explain in what manner the student is to set about measuring or estimating a building, in commencing and proceeding from the foundation to the top in brickwork, and from the roof downwards to the lowest floor in carpentry, or the method of proceeding on each floor in the joining, first with the floor, then the skirting, windows, doors, &c.; nor in the plasterer's work commencing with the ceiling, then the cornice, partitions and walls: we have just given this slight and hurried sketch to show that there is a system adopted by all surveyors of any practice in measuring a building, and without such a system, the tyro will get himself into a labyrinth of difficulties, and probably omit some important part of the works. We may probably at a future opportunity be induced to give some instructions on measuring, for we have often seen attempts to lay down rules for that purpose, but none of them appear to us to be of that satisfactory character which we think suitable to the student—however, the work now before us, for the present we recommend, as we consider it the best that has hitherto been published, and will render some assistance in valuing and making out builders work, and give some insight into the abbreviations, method of entering the measurement, the abstract and drawing out the bill of quantities.

A course of Practical Geometry for Mechanics, by W. Pease.—This book contains the principles of Geometry, which the author has condensed very satisfactorily into a small space, so as to render the work both cheap and useful to the student.

The Guide to Hayling Island near Havant, Hants.—To the visitors of this watering place this guide will be useful.

PROPOSED EXTENSIVE IMPROVEMENTS IN THE CITY OF LONDON.

At the last Court of Common Council, the Special Committee appointed to report upon the proposed improvements in the city, presented their report, which certainly contains numerous suggestions, but we fear it will be several years before they can be carried into effect; they observe that:

It has long been the subject of public complaint, that Newgate-street, Snowhill, and Holborn, the great thoroughfare to the north-western, and that of St. Paul's Churchyard, Ludgate-hill, and Fleet-street, to the western part of the metropolis, are both quite inadequate to the immense traffic of carriages, wagons, and vehicles of every description which throng in those directions; and the numbers of wagons and carts which convey provisions to and from Newgate-market frequently choke that thoroughfare, creating delays and inconvenience to the mail-coaches, and other impediments to the Post-office arrangements. The special committee having examined carefully those plans which have been suggested to the Commissioners of Woods and Forests for a new thoroughfare, commencing in the neighbourhood of Leicester-square, through Lincoln's-inn-fields into the city, crossing Farringdon-street by a viaduct, next considered the practicability of forming a street which would connect the end of Cheapside with such a thoroughfare at Lincoln's inn and with a branch diverging into Holborn, which would effectually relieve the great pressure of the public traffic in the thoroughfares alluded to, and at the same time render a viaduct at Holborn-bridge unnecessary. They were of opinion that the formation of a street combining these desirable objects was decidedly practicable, the street to commence at the east end, and continue along Paternoster-row, through Amen-corner, across Farringdon-street to the south-west corner of Farringdon-market in a straight line, the main line to continue across the middle of Fetter-lane to the city boundary, and a branch to diverge from the corner of the market to the end of Fetter-lane, at the summit of the hill in the wide part of Holborn. The special committee having had the levels in this proposed new line accurately taken, find that the greatest inclination of any part of it would not be more than about 3 feet in 100, and that only for the distance of 370 feet. It occurred to them in pursuing the investigation, that this new line would be still greater improved by the removal of the whole of the houses between the north side of St. Paul's Churchyard and Paternoster-row, from the end of Cheapside as far as Ave Maria-lane, which could be done for the additional sum of £150,000. Should this be effected, that magnificent structure would terminate a vista of upwards of one-third of a mile, and the whole would, in addition to the increased facility and convenience which would be afforded to the growing commercial traffic of the city, form one of the grandest improvements of an architectural character, yet achieved in the metropolis.

The order in which the special committee have classed the improvements which they consider called for, is according to the relative importance of each, and as follows:—

A. From the east end of Paternoster-row to Fetter-lane, and a branch street to Holborn, commencing with the houses at the west end of Cheapside, projecting beyond the line of St. Martin's-le-Grand, all between Paternoster-row, St. Paul's Churchyard, as far as Ave Maria-lane, Amen Corner, crossing the Old Bailey, to Farringdon-street, to Shoe-lane, Printer-street, Great New-street, to Fetter-lane to the city boundary; and the branch street from Little New-street, to the north end of Fetter-lane, Holborn, about 3360 feet in length. The great st acclivity in the whole of this line will not be more than 1 in 31, and that for only about 370 feet.

B. From the north end of Dowgate-hill to the east end of St. Paul's Churchyard, thence to Earl-street, Blackfriars, through Tower Royal, Little and Great Distaff-lane, crossing the Old Change into St. Paul's Churchyard, about 1360 feet in length, and from the Old Change, through Knight-rider-court, Carter-lane, Godliman-street, Bell-yard, Addle-hill, to the east end of Earl-street, about 1200 feet in length.

C. Watling-street, from Aldermary Church to the west end of St. Paul's Churchyard, about 1055 feet in length.

D. The Poultry, on the north side, to the Old Jewry, and 100 feet of the north side of Mansion-house-street, about 1055 feet in length; from the Mansion-house across Bucklersbury and Size-lane to Queen-street, from Watling-street to the east end of Basing-lane, the east side of Queen-street from Watling-street to Thames-street, about 1400 feet in length.

E. Lime-street, east side, from Cullum-street to Fenchurch-street, Leadenhall-market from Fenchurch-street through to the south end of Gracechurch-street, about 800 feet in length; Aldgate, south side, from the Saracen's Head to Jewry-street, and the east end of Leadenhall-street at its junction with Fenchurch-street.

F. Broad-street buildings to the Curtain-road, through Halfmoon-street to Sun-street, thence to Skinner-street, and on to Worship-street, about 1550 feet in length.

G. From Aldersgate-street, opposite the end of Jewin-street to Smithfield, and from the corner of Little Britain across Bartholomew-close, to communicate with the above line of street to Smithfield, about 1280 feet in length.

H. Threadneedle-street, north side, at its junction with Broad-street, and south side, from the church of St. Benet Fink, to Finch-lane, about 265 feet in length.

I. Holborn-bridge, north side, about 90 feet in length. Butcherhall-lane, east side, about 85 feet in length. St. Martin's-le-Grand, north-east corner, Angel-street.

K. Maiden-lane, north and south sides, about 275 feet in length; Jewin-street, south side from the corner; Redcross-street to Redcross-square, and north corner next Aldersgate-street; Aldermanbury, the west side of the south end; Milk-street, east side next Cheapside; White Rose-court, Coleman-street, and Mason's-alley, Moor-lane, south side, east corner, and north end, west side, from White-street to Type-street, and south end, Milton-street, east side; New Bridge-street, Blackfriars, through Tudor-street to the Temple.

"Having thus detailed these improvements, the special committee turned their attention to that part of the reference whereby we were directed to report our opinion as to the best means of accomplishing these objects, and having had under consideration the various improvements which have been carried out during the last 12 years, as connected with the avenues and approaches to London-bridge, ascertained that our expenditure in this respect has averaged about £150,000 per annum; a sum which they apprehended, if the same could be provided for a few years, would enable all the proposed improvements to be carried into effect; and feeling that the corporation have not the means at their disposal of effecting these improvements, however desirable the same may appear to be, the special committee were of opinion, as Her Majesty has been graciously pleased to appoint a special commission for the purpose of considering of further metropolitan improvements, which commission is now sitting, that a favourable opportunity exists for drawing the attention of the Government and the commission as to the best means to be adopted for raising the requisite funds for these purposes, and recommended that we should be empowered to confer with them upon this desirable object; and we agreeing with the special committee in the said report, submit the same to the hon. court."

The report was signed by 21 members.

THE TWEEDDALE PATENT DRAIN TILE AND BRICK MACHINE.

Fig. 1. Tile Machine.

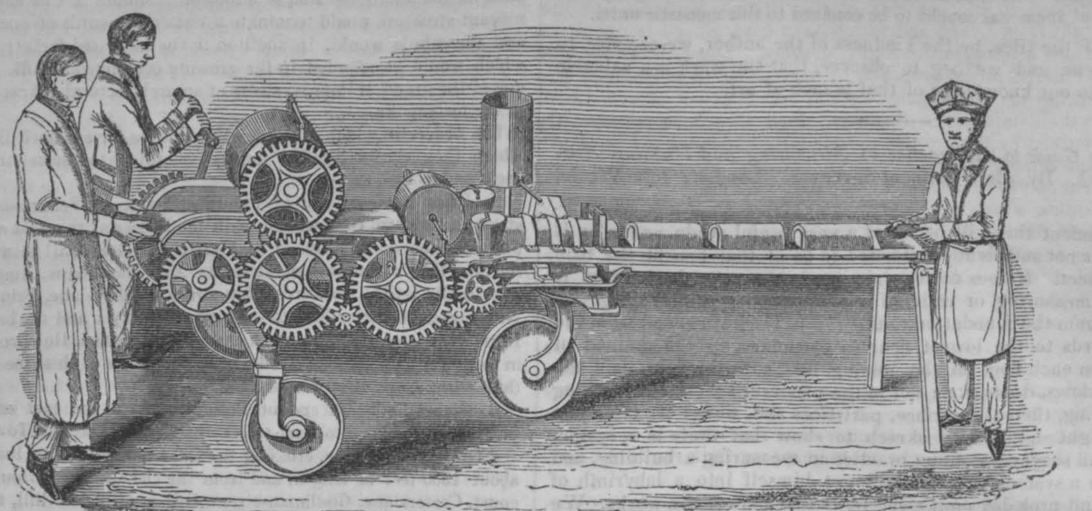
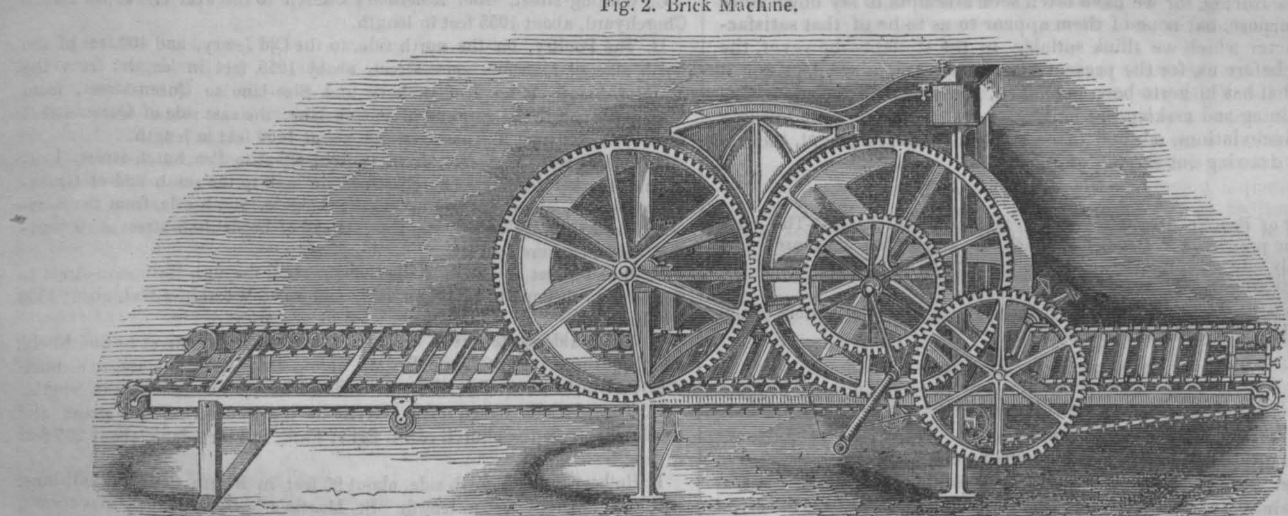


Fig. 2. Brick Machine.



THESE machines, the invention of the Marquis of Tweeddale, have recently undergone very considerable improvements, and are now made to be worked by manual power, and are so portable that they may be removed and placed in any part of the tile sheds or brick fields. Formerly the machines were worked only by steam power, which in many cases was found to be highly inconvenient and expensive, as it was necessary to have the machines fixed and the clay brought to them sometimes at a considerable distance. The new machines, exhibited in the above engravings, can be worked by one labourer independently of the filler and attendants to remove the bricks as they are made.

The machines act with great simplicity, yet with the utmost accuracy. The one used for tile making, Fig. 1, consists mainly of two iron cylinders, over which webs or bands of moleskin, or other suitable cloth, are made to pass. By this arrangement the clay is pressed into a web of uniform thickness, without adhering to the cylinders. It is then carried over a covered wheel, slightly curved on the rim, and begins to assume the bent shape of a draining tile; a tendency which is increased by several inexpensive but effectual contrivances; and the tiles are polished and finished by passing through three graduated iron moulds of horse-shoe form, as seen in the centre of the machine, being at the same time moistened from a cistern on the top of the machine. The tiles are then cut off, with mathematical accuracy, to such length as may be required (fifteen inches being generally recommended as the most profitable and convenient), and then they are conveyed to any requisite distance by an endless web, and from thence are placed by two lads on the drying shelves. Flat tiles, or soles, are formed in precisely the same manner; except that they are partially divided into two portions while passing through the moulds, the quantity of clay required for one draining tile being the same as for two soles. The tile machine will make from 10 to 15 bricks per minute.

The brick machine, Fig. 2, is on the same principle, but varied to suit the different character of the article required. The clay is placed in a receiver or "hopper" above the two cylinders; and it descends between them into a mould or box, in such a way as to become perfectly formed and pressed into the shape of a brick in the transit. By a recent skilful improvement, a series of palate-boards is borne along by an endless iron chain; and the adjustment is so correct that at the exact moment of passing under the mould, each board is lifted to receive the new formed brick as it is emitted from the mould, and separated from the main body of clay; the palate board then drops again into its place with the brick, and is conveyed horizontally along the web just mentioned; hence it is removed on to barrows by the barrowmen.

It is not the least of the merits of both machines that, although acting with the accuracy of clockwork, they are not liable to derangement; and that, while they are suitable for the application of steam or other power when very large quantities are required, yet they are so simplified as to be also within the management of a couple of common labourers, with the assistance of two or three boys to remove tiles, or the like number of men in the case of bricks.

The quantity of articles produced is not limited by the machines, as they will manufacture any number that can be conveniently taken away. The general range is from 15 to 20 bricks or tiles per minute, when hand labour is employed to work the machines.

Several of these machines are now in operation in different parts of the United Kingdom, and on the Continent. The principal portion of the bricks for the rebuilding of that portion of Hamburgh destroyed by fire, are, we are informed, made by these machines. One of the machines may be seen at the Company's wharf, Millbank, Westminster, near Vauxhall Bridge.

THE XANTHIAN MARBLES IN THE BRITISH MUSEUM.

Amongst the valuable, though to the public taste not the most attractive, additions to the contents of the British Museum, are the marbles brought from Lycia, and which have been placed temporarily in the two rooms leading to the Elgin marbles. These treasures not being as yet entered in the synopsis, or presenting to an ordinary observer no striking or remarkable feature, have not yet attracted that notice which their importance demands. Still they have not been altogether unnoticed by the crowds of holyday folk who have thronged to the Museum during the last few days, and who seem unanimously to regard them as "very ancient" and "very curious."

These marbles, which were discovered by Mr. Fellowes, while travelling in Asia Minor, in 1838, are said to be the most remarkable and important accession received by any European museum for many years, and have been obtained and brought to England in consequence of the greatest enterprise and self-denial on the part of the gentleman by whom they were discovered, and in consequence of whose representations respecting them they have been lodged in the British Museum. The marbles already secured to the British nation are but a small portion of those that abound in the interesting country from which they have been brought; they are, however, very valuable, and some idea of their quantity may be obtained when we mention that they were brought to England in 78 large and heavy packages.

The Xanthian, or Fellowes marbles, as it has been proposed to have them called, illustrate the mythology, the modes of warfare, and a variety of interesting features in the manners and customs of the ancient inhabitants of Asia Minor, who were originally settlers from Crete.

As might be expected, these sculptures do not, as works of art, rank with the Elgin marbles, but they are highly interesting as illustrating the state of sculpture in a much earlier age. They are supposed to include some of the earliest efforts of Greek art which have come down to our times.

The principal objects in the collection are those which Mr. Fellowes describes as the *bas-reliefs* representing the legend of the daughters of King Pandarus being carried away by the harpies, which were around the high square monument, which was called the harpy tomb. The marbles belonging to this tomb are placed in the centre of the grand central saloon, arranged as they were before being taken down. Near them is placed a model of the tomb, which was supported by a shaft 17 feet high, and weighing 80 tons, standing on a plinth 6 feet high. The tomb itself was 3 feet 3 inches in height, surmounted by a cover which weighed from 15 to 20 tons. The central saloon also contains some very beautiful frieze work, representing in *bas-relief* a bear hunt: all the figures, the horses and horsemen, the dogs, and the unfortunate bear itself, are very spirited and bold, but not highly finished specimens of art. Some of the figures on the harpy tomb, and those placed on the under ledge of the same large framework, bear a considerable resemblance to the figures on the monuments of Egypt; we may mention particularly the gods seated on chairs, one smelling a lily, and another giving a helmet to a warrior. In the anti-room there are several very rich friezes. One represents a sacrifice; the fire is burning on the altar, and a number of persons are approaching with various offerings, both animal and vegetable, and in cases the offering may be readily distinguished. The siege of the walled town forms in itself an interesting subject; the walls are defended by warriors armed with stones, which are also the weapons in general use among all the combatants; on the walls are a number of females, whose countenances indicate great distress, as they well may, for the artist has introduced an escalade, which is sufficiently indicative of the danger of the inhabitants. The friezes and the pediments in this room contain some figures, which for vigour of design, if not for beauty of execution, may vie with the Elgin marbles. Mr. Fellowes, in his account of the transmission of these marbles to England, remarks that the frieze so accurately illustrates the description given by Herodotus of the capture of the early city, that he could almost fancy that the neighbouring historian had written his history from it, commemorating an event which happened about a century before his era. We understand that a room is to be prepared expressly to receive this valuable addition to the antique sculptures with which our great national collection is enriched.—*Times.*

DREDGING AND DREDGING-MACHINES.

Sir—As to working a machine a-head by the engine, although, as you remark in your foot note to my communication on this subject, in the last number, it is one of the most obvious applications of the engine power, yet it is not equally so under all circumstances. Where a machine is used to keep a harbour dock or navigation *clean*, the application is most obvious and advantageous, as the traverse of the machine may be quite uniform; but where the natural bottom has to be dredged out, the advantage is not so great. Indeed, in such a case, it is impossible to apply a *constant* power to the bow chain in trench cutting, (or the lateral chains in radius cutting,) else the machine would be broken by natural interruptions, such as stones and roots of trees occurring. But if the engine power be applied to a crab-winch, and the chain be brought with about three turns round the winding barrel, so as to give it just sufficient friction to drag the machine under the ordinary resistance to the buckets, and of course allowing the end of the chain to coil upon the deck, an intermittent motion may be had. If, however, a man attend to this crab-winch while the machine is at work, and on the given signal from the captain, throws a slack of chain on the winding barrel to cause it to slip, and so stop the advancement of the machine, this motion may be rendered quite as manageable as if performed entirely by manual labour. It would, of course, be an object to dispense with the attendance of a man at the crab-winch or with the winch also, and to wind the chain on a barrel at the engine, but then no friction straps or the like could produce such a motion as that given by the man letting the chain slip or lose hold entirely, as required. A fast and loose gearing would scarcely do, but, with friction cones, it would certainly approximate to a hand motion, sufficient for ordinary cutting.

In my communication last month, I did not say what motive power I would apply to the lateral chains therein proposed, but the above remarks apply equally to them as to a bow chain. Where the motion of the machine (*i. e.* the progressive motion of the machine or boat to the stuff) may be uniform, the application of engine power would be an additional saving, as they would only require an occasional inspection, but in the case where the motion must be intermitted, the method of "radius cutting" reduces the labour of winding so much, that if a man attend to the chains he can also wind them. In a small machine, about 50 feet long, one lateral chain on each side may be sufficient.

As the reduction of the number of hands required to work dredging machines must be an object with every engineer whose works require the use of them, in as much as it is creditable to raise the stuff at the least expense which local and other circumstances will permit, many ingenious arrangements might be thought of. In those machines in which the bucket ladder is placed in the centre of the boat, there are levers at hand, by which the captain, while taking the soundings in the well, can raise and lower the ladder. In the same manner, when engine power is applied to the crab winchs, rods might be brought from their fast and loose motions, so as all to be at one point. Always adapting the machine to the nature of its work, I am not aware of any works where the machines are divided and adapted to different sorts of work, which has made me keep this point in view in my preceding remarks.

If each machine be adapted both for light and heavy work, there must be a waste of power; but more on this again.

W. C., C. E.

30, *Hope Street, Glasgow*,
26th April, 1843.

Paris.—The monster elephant which has for 30 years guarded the Plac de la Bastile, in memory of Napoleon's Egyptian exploits, is about to be cast in bronze, for the decoration of a grand fountain to be erected in the Place du Trône. The giant animal is already caged, for the purpose, within a system of boardings forming a vast workshop, and at once exciting and baffling the curiosity of the Parisian street hunters. The papers also state, that the commission for erecting the tomb of the Emperor Napoleon has come to a decision that the baldachin of the altar at the Invalides, with its gilded columns, shall be suppressed; that the equestrian statue of the Emperor shall be erected on the Esplanade, and not in the Cour Royale, as designed by the architect, and that the figure of the Emperor shall be in his historical dress, and not in the Roman costume. The Minister of the Interior has given commissions for twelve statues, to be placed in the niches of the principal façade of the new buildings at the Hôtel de Ville. The following are the subjects:— Frochot, Voyer d'Argenson, Etienne Robert, Vincent de Paule, L'Abbé de l'Epée, Robin, Jean Aubry, Hardouin-Mansard, Guillaume Budé, Mathieu Molé, Michel Lallier, and La Vacquerie.

C. W. WILLIAMS' ARGAND FURNACE.

Questions relative to the effect of C. W. Williams' Argand Furnace, as answered by the Commanders and Engineers of the undermentioned Steamers, 28th March, 1843.

NAMES OF STEAMERS.	*How long since the apparatus was introduced into your Vessel.*	*Did your furnaces make much smoke before they were altered?*	*Do they make less smoke since they were altered?*	*Had you a sufficient supply of steam before the furnaces were altered.*	*Have you as good or better command of steam since the alteration?*	*Does the use of this Apparatus effect any saving of fuel, and to what extent?*
HIBERNIA.	12 months.	A great deal of smoke.	Much less smoke, scarcely any to be perceived.	Yes — but not too much.	Yes—a great deal better, and was enabled to blow off copiously.	On the average of trips we save at least 3 cwt. per hour.
BALLINASLOE.	7 months.	Not much smoke.	Since the alteration there is less smoke than before.	Yes.	I should say a better command of steam, though we have *new cylinders of larger dimensions.*	Consumption much about the same as before, notwithstanding about 16 horses power added, and an increase of two revolutions.
NOTTINGHAM.	19th April, 1841—say two years.	Yes — a very thick black smoke.	No smoke is now made except when fires are first lighted, or coals are being thrown on.	No — scarcely enough of steam.	We have now an abundant supply of steam.	Consumption of fuel the same as before.
ATHLONE.	7 months.	A great quantity of smoke was made previously.	No smoke is now made after the fires are put in good order — a light smoke when men are firing.	Rather insufficient in steam.	We have now a very plentiful supply of steam.	About four tons of fuel less is now consumed in the trip than before the alteration.
ROYAL ADELAIDE.	10 months.	Yes—we smoked very much.	Only when fires are first lighted, or with bad coal.	No—we had but little except with very good coal — then with great exertion we worked to full power.	We are convinced we have, and particularly with good coals.	Yes — this is experienced when burning good coals, but not when with a bad quality.
ROYAL WILLIAM.	Nov.23, 1843	Made much smoke with the former boilers.	Very little smoke now.	The apparatus attached when the present boilers were put in.	Sufficient supply of steam.	Apparatus always applied to these boilers.
PRINCE.	Always to these boilers.	Smoked much with former boilers.	We have made very little smoke since the commencement, with present boilers.	Apparatus always attached to present boilers: plenty of steam at all times.	Apparatus always attached—plenty of steam at all times.	Apparatus always attached, therefore cannot say.
PRINCESS.	9 months	A great quantity of dense black smoke.	They now make scarcely any smoke after the fires are well lighted.	We had sufficient before the alteration.	We have quite sufficient, as we had before.	Without the air pipes we made 16 voyages .. 371 hrs. Coals consumed 571 tons With the air pipes we made 16 voyages .. 379 hrs. Coals consumed 522 tons Saving .. .. 49 tons
LEEDS.	Above 2 years	Going before the wind they smoked considerably—at other times not so much.	No smoke except when firing up or making the fires, and then only a short time.	We always had a good command of steam.	We have better command of steam; if the coals are good, we can make any quantity of steam with the greatest ease.	To the best of our judgment, about 4 cwt. per hour.
BIRMINGHAM.	1 month.	At times they smoked.	No black smoke now appears while under way, but sometimes a little gray colour a few seconds after firing.	I have always a sufficient supply of steam.	At all times a sufficient command, and are now enabled constantly to blow off steam.	We save about 1 cwt. to 1½ cwt. per hour.
MARS.	9 months.	A dense black smoke.	Much less smoke.	No, we had not sufficient steam.	Very much better.	From the nature of our service I cannot say.
ORIENTAL. (*From Alexandria*)	20 months.	Yes—we smoked considerably, as much as any vessel of our class.	After all is warmed through we do not smoke, only when firing up or raking, and then only a slight volume for a few seconds.	We were always pretty well for steam when using good coals.	We consider that we have a much better supply with the air apparatus—there is no question of it.	We think we are saving from three to four cwt. per hour. For many voyages our consumption averaged 26 cwt. per hour. It was 30 cwt. previously.
HINDOSTAN. (*From Calcutta.*)	Put in on arrival at Southampton	Voyage from Liverpool to Southampton, smoked much, from both funnels.	Smoke is now seldom or never seen.	Not over abundant.	Sufficient steam now.	The air boxes are a great saving, both in fuel and supporting the bridges.
SHANDON. (*Glasgow.*)	4 months.	A great quantity of smoke.	Smoke nearly done away with, except at firing, and when raising steam from cold water.	Sufficient.	Much about the same.	From 15 to 20 per cent. of fuel is saved.
DÆDALUS. (*Liverpool.*)	9 months.	A great deal of smoke.	No smoke now except when the fire is lighted.	Not half enough.	Much better.	Yes, at least one-third.

Since the above was printed, the *Queen Victoria* (in Liverpool) and the *Branda* (in Glasgow) have been added to the list, in both of which the apparatus has been successfully applied.

C. W. WILLIAMS' PATENT SMOKELESS ARGAND FURNACE.

SIR—As the application of Mr. C. W. Williams' Argand Furnace to marine boilers has been questioned, we beg to request your giving room to the accompanying tabular view of its adoption on board several steamers, and to add that the apparatus continues to be applied to such boilers as from their construction are susceptible of improvement.

I am, Sir,
May 5, 1843. Your's obediently,
DIRCKS & Co.

P.S. By the returns in the foregoing table it will be seen that the advantages are greater in some vessels than in others. This difference is chiefly attributable to the construction of their boilers. In marine as well as land engine boilers, the arrangement of the flues frequently renders them incapable of improvement; such arrangement not only injuring the draught, but tending to obstruct, rather than aid, the natural and chemical process of the combustion of the gaseous matter of the coal. In some of the boilers in the above table, there appears to be a considerable saving of fuel where there had been a sufficiency of steam. In others, the advantage of the apparatus is shown by obtaining a better supply of steam from the same quantity of fuel. In all, the great evil of smoke is avoided. Where furnaces are properly attended to, by having the bars kept *thickly* and *uniformly* covered with fuel, smoke will be prevented, and more heat generated. Any deviation from this, by having the fire bars too long—by improperly feeding the furnaces or allowing the fuel to burn in holes or irregularly—or by heaping the fresh coals in front, and allowing the back part of the bars to be uncovered or without the full supply of fuel, will be attended, either with the generation of *visible* smoke, or the escape of the gases unburnt, though *invisible*, with a loss of heat, and consequently a diminution of steam. It is here to be noted, that the absence of *visible black* smoke is no test of the combustion of the gases. What is called the "combustion of smoke" is not unfrequently the effect of the mismanagement of the fuel, by which its inflammable gases pass away in an *invisible* form. Smoke is the result of the imperfect process of combustion of the gases, and as the process cannot be twice performed in the same furnace, the "combustion of smoke" is hence a chemical absurdity. Dr. Ure, writing to Mr. Williams, says, "I quite agree with you in considering the *prevention of smoke* to be the true mode of curing the nuisance; for when the carbonaceous particles become deposited, it is impossible effectually to burn them, so as to destroy the smoke which they occasion, or rather constitute." Professor Brande says, "As to the quibble about *burning smoke*, it is, in other words, burning what is to be presumed has already been burned, and therefore cannot be burned twice over," &c. "I can see nothing that in the least invalidates your views respecting the *prevention of smoke*, by the combustion of that which would become smoke, *if you would let it*."

NOTES ON THE USE OF SUBLIMATE OF MERCURY AND SULPHATE OF ZINC, AS PREVENTIVES TO DECAY IN TIMBER.

VARIOUS attempts have been made by different individuals to render timber indestructible, both as regards fire and the hand of time, also to render timbers of inferior qualities equal in hardness to those of the best description; for the two latter purposes a solution of pyrolignite of iron and chloride of lime have been employed, and for the former, solutions of the sulphates of copper and iron. It has long been known that the saturation of skins of birds and anatomical preparations, in a solution of corrosive sublimate of mercury, tended to their preservation, and it was suggested by Sir H. Davy and also by Mr. Chapman, that the same solution was capable of preserving timber; but it was reserved for Mr. Kyan to bring the subject to bear in practice, who, as long ago as March 4, 1828, submitted some timbers to his new process, and the first examination of which took place in three years afterwards, and the second in July, 1833, five years afterwards. Since then the use of sublimate as a preventive of dry rot and decay has been termed Kyanizing, after Mr. Kyan, who, in 1832, took out letters patent "for a new mode of preserving certain vegetable substances from decay," and in the same year had some specimens of timber, prepared with the solution, tested in the fungus pits of Woolwich dockyard, which stood the trial satisfactorily. In 1835, the paling of Regent's Park, in London, was so prepared, and in the same year Sir Robert Smirke employed Kyanized timber in the erection of the Oxford and Cambridge Club, and Messrs. Grissell and Peto, the builders, erected tanks and purchased the use of the patent, and Mr. Samuel Beazley, the architect, reported, in Jan. 1831, favourably of the paling in the Regent's Park, which had been submitted to the process. The above authorities, I have no doubt, gave the system of Kyanizing an impetus of which it has not yet lost the beneficial effect. Above twenty railway companies used the patent for the preparation of the sleepers of railways, both for cross and continuous bearings; it was used on the viaducts of timber on the North Shields Railway, by Messrs. Green, and also by the Honourable Commission for the repair of the Menai Bridge. The Kyanizing system has been introduced into Holland, where the Commissioners of the Dutch government made a favourable report in May, 1838, and it has also been used for the Austrian railways. A company is now using the patent in England under the title of "The Anti-Dry-Rot Company."

An improvement on mere saturation was suggested and acted upon by Sir William Burnett, in Aug. 1836, and being favourably reported on by the Admiralty, a tank was erected at Portsmouth, being of wrought iron, 52 ft. long, and 6 ft. diameter, and another was erected by the Hull & Selby Railroad Company, 70 ft. long 6 ft. diameter. The Anti-Dry-Rot Company, under Kyan's patent, has also a 60 ft. tank and hydraulic apparatus, at their works, City Road Basin. The timber is piled inside these tanks with interstices, and the air is exhausted by a pump to a vacuum of 25½ in. of mercury, and the solution then admitted, and submitted to a pressure of 100 lb. by a force pump, by which means the saturated solution is forced into the pores of the wood. Some doubts have been expressed as to whether the proper effect is obtained by this mechanical process, the action being chemical, and time for saturation being required.

The report of the Committee appointed by the Lords of the Admiralty printed by order of the House of Commons, July 9, 1835, contains the following observations, founded upon some experiments made at Somerset House. The solution used for preparing the timber, contains 224 lb. of the corrosive sublimate to 1062 gallons of water, or about 1 lb. to 5 gallons, and the cost of the sublimate 3*s.* 7*d.* per lb., and that the solution diminishes in bulk and not in strength by use.

Professor Faraday delivered a lecture at the Royal Institution on dry rot, in Feb. 1833, Dr. Birkbeck at the Society of Arts, Dec. 9, 1834, and Robert Dickson, Esq., at the Institution of British Architects, April, 1837, and a pamphlet was published by J. C. Adlard on Kyan's process, all approving of the process, which show the prominence this subject has assumed within late years.

The following is the cost of Kyan's process as first promulgated in January, 1836:—

	s.
Licence per load of 50 cubic feet	5
1 lb. of corrosive sublimate to 10 gallons of solution ..	5
Labour to 1 load of timber, filling and emptying tank, and unloading	5
Risk and profit, 25 per cent.	5
Cost of a load of 50 feet ..	20*s.*

Deals require to lie in the tank three days, and an extra day for every inch in thickness.

The largest tanks for mere saturation that I have any account of, were erected for the Great Western Railway Company, at Bull's Bridge, near West Drayton, under the direction of the engineer to the Company. These tanks were 9 ft. deep, and of an oblong trough shape, the size at the top was 84 ft. by 19 ft., and at bottom 60 ft. by 12 ft. 8 in. The sides were of 4 in. plank, American pine, supported on sills 12 in. by 10 in., and upright framing 10 in. by 10 in., and with sloping diagonal braces, 8 in. by 8 in., of which framing there were 9 sets in the length of the tank. The whole was sunk into the ground nearly level with the surface, the uprights standing about 2 ft. above the sides, to which were attached transoms to keep down the timber in the solution. The tendency of the timber to float was so great, that notwithstanding the bearing was only 19 ft., and the transoms 15 in. by 12 in., they were cambered or bent upward nearly an inch and a half, and in one instance the whole tank was disturbed from its seat; the thickness of the sides being only 4 in. plank, the solution escaped, and ran into a ditch which communicated with a fish pond at a distance of about 600 yards from the tank; and notwithstanding the reduction in strength, the fish in the pond were killed.

The sublimate was dissolved in hot water, and added to the water in the tanks, the hydrometer being used to test its strength. At the end of the tank a mast was erected with a traversing boom, so as to be used as a derrick in filling or emptying the tank of timber. As a test whether the solution had penetrated to the centre of the timber, hydrosulphuret of ammonia was used, and if the solution had penetrated sufficiently into the prepared timber, being touched with the test a black stain would soon become apparent, although I must say I have not seen it act successfully when the timber was split far from the surface.

The preservation of timber from the dry rot is at the present moment attracting considerable attention, in consequence of Sir W. Burnett's process having superseded Mr. Kyan's in the good opinion of the authorities of the navy. The *United Service Journal* for April has an article on naval improvements in the 19th century; from the fourth notice on dry rot, is condensed the following account of Burnettizing. It appears that Sir W. Burnett, Physician General of the Navy, knowing that the precipitate caused by Kyanization was soluble in sea water, substituted water saturated with the chloride of zinc, with decided and beneficial effect; and "we trust," says the editor of the *Journal*, "the day is not far distant when not a load of timber or a bolt of canvas will be used in Her Majesty's service without being Burnettized." The principle of Burnettizing was reported upon by the Master of Woolwich Dockyard and his assistant, 15th July, and by the Admiralty, 26th July, 1841. Tanks are established at each of the dockyards, at Portsmouth, Plymouth and Chatham; that at Portsmouth is 6 ft. diameter, and 52 ft. long, and proved to a pressure of 200 lb. on the inch. In consequence of the successful results of all the experiments, Sir William was induced to take out a patent. In the above named Journal, amongst the correspondence, is a letter from the Liverpool Registry of Shipping stating that rock salt filled between the timbers of the frame of a ship, is a preventive or cure for dry rot, even after it has made its appearance. In the *Mining Journal*, March 18, 1843, from a letter by J. Murray we learn that he applied sulphate of iron and a partial vacuum, caused by steam injection, to assist the penetration of the solution, 10 years before Kyan's process; through the same channel, he also states that salts of copper will coagulate albumen as well as chloride of mercury. The tanks of the Hull and Selby Railway, previously noticed, are more fully described in Vol. 5, page 202 of the *Journal*, being an account of the meeting of the Institution of Civil Engineers, March 8, 1840, where it is stated that 50 out of 70 of the prepared sleepers, used at the West India Dock warehouses, after being down for five years, were rotten, they had been prepared by simple immersion or saturation; and it is also stated, that some tanks of the Anti-Dry-Rot Company, in which the solution was kept, had decayed, and that the action of corrosive sublimate would be prejudicial to the use of iron bolts in Kyanized sleepers.

In the application of Kyanizing to railways, Mr. Giles was the first to apply it on the Southampton Railway; and of its application to building, Sir Robert Smirke at the Temple in 1833, also at the Custom House, Bristol, the Oxford and Cambridge Club, and the British Museum; also by Mr. Wilkins, in the erection of the National Gallery, and by Mr. Barry, at the College of Surgeons, in 1834, and in the same year by Mr. Abraham, at the Westminster Bridewell; and it has been also employed at Ramsgate Harbour by Andrew Turnbull, C. E. The above enumeration of works, in addition to the attention bestowed at the meeting of the Institution of Civil Engineers, is, I think, evidence enough to show that Kyanizing has not been superseded in public estimation by Burnettizing without a fair trial of its merits. Both processes, I think, will fall into desuetude, not from any defect in principle or not answering the end in view, but from the first cost of the tanks, the delay in time, the vessel not being capacious enough, and the extra delay and expense in delivery and cartage of the materials from place to place, or from the tanks to the works where the materials are required. This, I know, that the Kyanizing has signally failed in taking root in the provinces, and I could specify at least ten places where it has been given up. With respect to a railway with two lines of road where it is used, the cost per mile will be as follows: where cross sleepers are employed, each sleeper contains from 2 to 2½ cubic feet, and costs from 12*d.* to 13*d.* each for Kyanizing, exclusive of cartage from the place of delivery to the Anti-Dry-Rot station, and from thence to the works where they are required for use. The cost of sleepers of Scotch fir is about 4*s.* each, and of larch 5*s.*; price, of course, is ruled by the locality, taking, however, the cost of Kyanizing and cartage at 1*s.* 6*d.* per sleeper, and a double way, and placing the sleepers 3 feet apart, (although recently they are placed only 2 feet 3 inches apart,) and there being 1760 yards in a mile, the total cost of Kyanizing will be £132 per mile, which on some of the long lines amount to the sum of £20,000, an amount which ought not to be too rashly entered on without ue inquiry.

In conclusion, I beg to be allowed to state that I was engaged in the use of the Kyanizing when Messrs. Grissell and Peto employed it; also, in the erection of the tanks of the Great Western Railway Company, and in the superintendence of the process, when performed by local establishments, o the Anti-Dry-Rot Company. I state this, to show that my opinion is not rashly formed, when I say that Kyanizing is grown into disuse, and that probably Burnettizing will also share the same fate, perhaps, without having so long a trial. With the concluding remarks of the Lecturer on Engineering at King's College, as given in a late number of the *Journal*, I cordially agree, viz., "'tis use alone that sanctifies expense." Although this paper may not possess the merit of being thoroughly original, yet I think it may claim no lack of inquiry into the writings of previous inquirers as to the merits of this question of preventives to decay in timber. To yourself my thanks are especially due, for your liberality and condescension in noticing my previous efforts, as a correspondent to your valuable periodical, amongst the general notices, as being the results of labour, and as valuable communications, but more especially for the particular notice in Vol. 5, page 397, where my efforts are designated as "practical and of great utility." Your kindness has given my study and reading an object, which is to employ my leisure profitably in the advancement of knowledge, and becoming of practical utility to my fellow men.

St. Ann's, Newcastle-upon-Tyne. O. T.

NEW PROCESS FOR MANUFACTURING LIME, &c.

A Patent has been granted to William Edward Newton, of Chancery Lane, for "*improvements in manufacturing lime, cement, artificial stone, and such other compositions, more particularly applicable to working under water, and in constructing buildings and other works, which are exposed to damp.*" (A communication.)—Sealed the 3rd of April, 1841.

This invention consists, Firstly—in the formation, by certain new processes, of an hydraulic lime and cement, which has the property of becoming hard and solid, when under water, or exposed in damp situations. Secondly—in the application of the same principles to the hardening of soft stones, for the purpose of making hard artificial stones. Thirdly—in the employment of the same process for hardening wood, and preserving iron from the effects of damp, &c.

The following is the principle upon which the invention is founded, and the methods employed for carrying it into effect: The property which certain sorts of lime possess, of being hydraulic, or hardening under water, is caused by a certain combination of the lime with silica, alumina, and sometimes also with oxide of manganese, and oxide of iron. The object then of this invention, is to facilitate the combination of the lime with those oxides, by means of agents not hitherto employed. Thus, in operating by the dry method, as is generally the case, instead of calcining the lime-stone or lime with sand and clay, the inventor, in order to facilitate the combination of the silica and alumina with the lime, introduces a small quantity of potash or soda, in the state of carbonate, sulphate, or chloride, or of any other salt of these bases, susceptible of decomposition, or becoming a silicate, when such calcination takes place. The salt of potash or soda, the quantity of which varies from three to six per cent. to the quantity of lime, is employed in the state of solution, so as to penetrate and mix better with the alkaline salt in the chalk or slacked lime. Calcination effects the rest, in the ordinary manner.

In order to combine or incorporate more equally, by the dry method, the alumina, and the oxides of manganese, and of iron, with the lime, the sulphates of these bases are first decomposed by the slacked lime, by making a paste with a solution of the sulphates, mixed with the lime. This paste, into which the sulphates in question enter, in the proportion of from six to ten per cent. of the lime, is then calcined, in order to produce an hydraulic lime. All sorts of lime are made hydraulic, by the humid method, by mixing slacked lime with solutions of alum or sulphates of alumina; but the best method consists in employing a solution of the silicates of potash, or of soda, called liquor of flints or soluble glass. An hydraulic cement may also be made, which will serve for the manufacture of architectural ornaments, by making a paste of pulverized chalk, and a solution of the silicate of potash, or of soda: in working with this plaster, it becomes much harder than ordinary plaster.

These same silicates of potash or soda, dissolved in water, will also harden chalk, or soft and porous stones, and transform them, artificially, into hard stones. In order to do this, these soft stones, either rough, or cut into their proper forms, must be soaked in a solution of the silicate, either warm or cold, and allowed to remain there a longer or shorter time, according to the degree of hardness which it may be necessary to give them; after which, they must be taken out and left exposed to the air. At the end of a few days, stones, thus prepared, will have acquired a hardness equal to that of marble; and this quality, in a little time, pervades the whole mass; for if, for the purpose of polishing, the outer coat or surface be removed, the inner one, which at first is not so hard, will harden in its turn, by exposure to the air. This takes place as far as the silicate has been able to penetrate. A more superficial hardness is obtained, by applying the solution of the silicate of potash or soda, by means of a brush. It is in this manner that walls, constructed of chalk and mortar, may be hardened. Sculpture, and various other objects, which may be made or prepared in chalk, may be hardened, and afterwards serve for decorating buildings, and other purposes, without the fear of their becoming injured by frost or damp. Chalk, hardened in this manner, may also be used as a substitute for the stones now employed by lithographers. Plaster models may also be hardened, by placing them, for some time, in a solution of the silicate; but it would be still better to add a portion of the solution to the paste, at the time of making the model, or using the plaster. The silicate of potash or soda is prepared by fusing one part of white siliceous matter with from one and a half to two parts of potash or soda, in the ordinary reverberatory furnaces, or in a glass-maker's or iron crucible. The solutions may be used of any density for plaster; but they should be weaker for chalk. In the last place, the inventor has found that the silicates of potash or soda, when dissolved in water, decompose spontaneously in the air, and cover the objects, to which their solution has been applied, with a strong covering or layer; therefore, by applying the solution of silicate of potash, or of soda, to polished iron, and allowing it to dry in the air, the metal is preserved from oxidation. By soaking wood many times in this solution, and allowing it to dry in the open air, every time after it has been placed therein, it becomes so much penetrated with silica, that it acquires a considerable density and degree of indestructibility.

The solution of the silicate of potash is not the only substance which, by being injected into porous bodies, tends to harden them. A mixture, made from a solution of bicarbonate of ammonia, and of chloride of magnesium, may be successfully employed; or a mixture of the solutions of ammonia and chloride of calcium may be used. In these latter cases, instead of having siliceous injections, they are either magnesia nor calcareous. Soft and porous stones may also be considerably hardened, and defended from the action of damp, by first well drying them, and then dipping or steeping them in sulphur, or some natural or artificial resinous or bituminous substance, rendered liquid by heat.

The patentee claims, Firstly—the application of certain new means, to change or convert all descriptions of lime into hydraulic limes and cements, or such as become hard under water, or when exposed in damp situations, by combining these limes and cements, with silica, alumina, the oxide of manganese, or the oxide of iron, either by the dry or humid method. Secondly—the manufacture of hard artificial stones from chalk, plaster, and all porous stones in general, by injecting into them, or imbuing them with silica, or the carbonates of magnesia or lime, by any of the above-described processes; or by causing them, by virtue of their porous nature, to absorb either melted sulphur, or bituminous, resinous, or fatty matters, properly liquified by means of heat. Thirdly—in the employment of the silicates of potash or soda, for making or forming a stony plaster or coating upon a variety of substances; thereby preventing iron from becoming rusty or oxidized, and rendering wood and other organic matters harder, and not liable to decay.—[*Inrolled in the Petty Bag Office, September*, 1841.]—*London Journal.*

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

February 3.—The PRESIDENT in the Chair.—*(Continued.)*

The Thames Tunnel.—Sir M. Isambard Brunel presented a design intended to illustrate the mode of securing the poling-boards of the shield of the Thames tunnel. The poling-boards, shown in the drawing, he described as being intended to close the whole area of the excavation in the front, as the side and top staves were intended to secure the sides and top of it. The shield (weighing nearly 180 tons) in passing over the ground, served materially to compress it, and make a firmer foundation for the tunnel. When it was considered that the mass of ground removed weighed 63,000 tons, while the brick structure by which it was replaced weighed only 26,160 tons; some idea might be formed of the difficulties which had been encountered in the progress of this undertaking. It would be seen by reference to the early reports, that 540 feet of tunnel had been made in the course of sixteen months, viz., from the 1st of January 1826, to the 27th of April 1827. At that period the miners and bricklayers struck, without even securing their work. In this emergency, after standing still a week, new hands were engaged; the result was, that on the 11th and 12th of May, the ground showed symptoms of giving way, and on the 18th the river broke in and completely filled the tunnel; the length of brickwork then completed was about 550 feet. He was convinced that no irruption would have occurred but for the desertion of the men, for at no previous period had so much work been done; the average progress being 12 feet per week for sixteen weeks, and having at that time the advantage of his son's services and those of experienced assistants, the work might have continued, and the tunnel would have been finished in about four years. After this irruption, an advance of only 50 feet was made within the period of the year 1827, and in consequence of a second irruption, the work was totally abandoned. In the year 1835, after a lapse of seven years, being liberally assisted by the Government, a new shield was provided, and the work was resumed in the beginning of March 1836. The work, however, proceeded very slowly as contrasted with former periods. On the 11th of June the water broke in and continued to trouble the works for six weeks. Having succeeded in repelling this attack, the progress for the whole year amounted to 117 feet. Foreseeing that he should at some future period, have to account for the causes of these delays, Sir Isambard instituted, in the course of the year (1836), distinct sets of records for every branch of the service, afloat as well as underground, in order to place beyond doubt, the circumstances which might not otherwise be credited. These registers enabled him to give the minutest details of the work, and would, he hoped, be found useful in any future similar undertaking. Through the whole of the year 1837, the progress was only 28 feet 4 inches, a rate which hardly exceeded that of a fortnight of the year 1827. Two irruptions took place within the range of eight feet, owing to the looseness of some portions of the strata, which were so fluid, that the only expedient for advancing, was by forcing forward some of the polings with the screws. The frequent bursts of gas at that period, and in 1838 and 1839, had moreover such an effect upon the men, that some of them fell senseless at their post. There was therefore great risk of the poling boards falling down, as had been the case before, and causing a total disruption of the ground. In this dilemma, the expedient of connecting the poling boards with each other by hooks was resorted to, forming by this means a complete panel in the face of each of the 36 cells of the shield; the top poling being suspended to the head of the cell, the panel could not be disturbed even with a cavity in front of it; there was likewise an additional means of supporting the polings, by iron spurs resting upon the floor-plates and going into the ground. Notwithstanding the apparent increase of labour occasioned by this addition to the poling-boards, good progress was made, amounting to 249 feet in the course of twelve months, and the hooking was found so safe in its service and its results, that were another tunnel to be constructed, Sir Isambard stated, that he would make the system of attaching the poling-boards, an essential part of the organisation of the shield, being convinced that it might by this means, be worked through the worst ground, with a certainty of safety and success.

February 14.—The PRESIDENT in the Chair.

"*Description of Mr. Clay's new Process for making Wrought Iron direct from the Ore; as practised at the Shirva Works, Kirkintillock, Scotland.*" By William Neale Clay.

In this communication, the author first describes the various stages through which the metal passes, between the reduction of the ore and its arriving at the state of malleable iron, by the ordinary mode of manufacture; and then he explains the process which he has invented, and introduced practically at the Shirva Works.

By the ordinary system of iron-making, the ores are reduced into the state of carburet of iron, and then, by refining and puddling, the metal is de-carburetted, thus making it into malleable iron by a number of processes, which are recapitulated:—

1st. Calcining the ore.

2nd. Smelting in a furnace, by the aid of blast, either cold or heated, with raw coal, or coke, for fuel, and limestone as a flux.

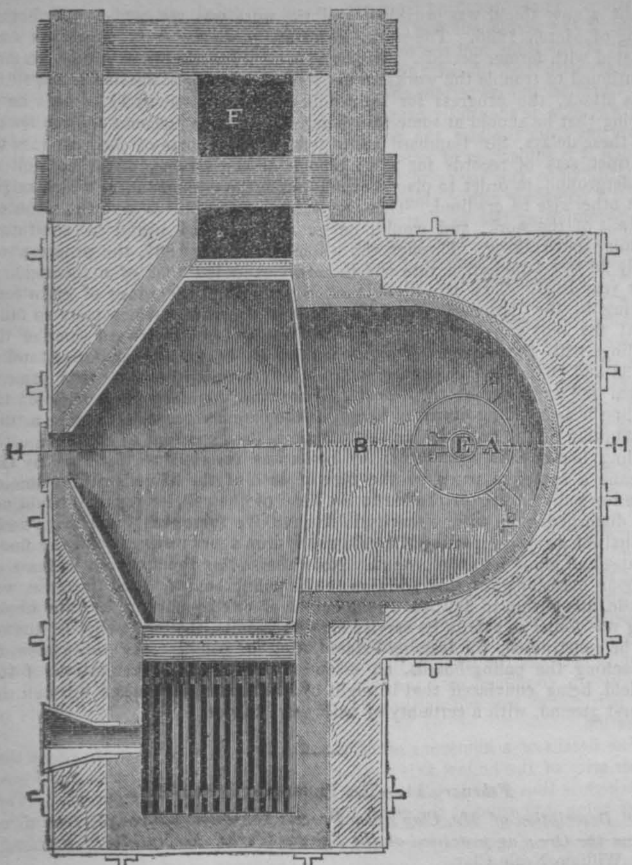
3rd. Refining the "pig" into "plate" iron.

4th. Puddling, shingling, and rolling, to produce the "rough," "puddled," or No. 1 bars.

5th. Cutting up, piling, and rolling, to produce "merchant," or No. 2 bars.

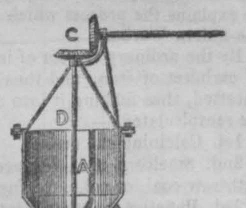
6th. A repetition of the same process, to make "best," or No. 3 bars.

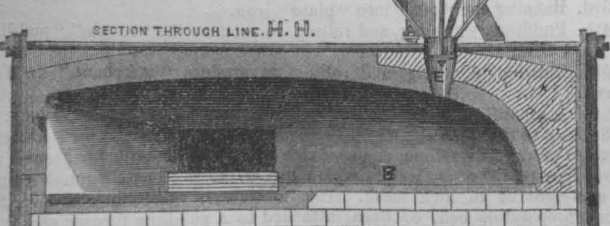
Seeking to diminish the number of manipulations, by the new process a mixture of dry Ulverstone, or other rich iron-ore (Hæmatite) is ground with about four-tenths of its weight of small coal, so as to pass through a screen of one-eight of an inch mesh. This mixture is placed in a hopper, fixed over a preparatory bed, or oven, attached to a puddling furnace of the ordinary form. While one charge is being worked and balled, another gradually falls from the hopper, through the crown, upon the preparatory bed, and becomes thoroughly and uniformly heated; the carburetted hydrogen and carbon of the coal, combining with the oxygen of the ore, advances the decomposition of the mineral, while by the combustion of these gases, the puddling furnace is prevented from being injuriously cooled. One charge being withdrawn, another is brought forward, and in about an hour and a-half the iron is balled, and ready for shingling and rolling. The cinder produced, is superior in quality to that which results from the common system; it contains from 50 to 55 per cent. of iron, and is free from phosphoric acid, which frequently exists, and is so injurious, in all the ordinary slags: when re-smelted, it produces as much No. 1 and No. 2 cast-iron, and of as good quality, as the ordinary "black band" ore of Scotland. The cast-iron produced from the slag (amounting to one-third of what was originally contained in the ore) is mixed with the ore and coal in the puddling furnace; and thus, while nearly all the iron is extracted from the ore, as much wrought iron is produced in a given time, and at the same cost of fuel, as by the old system. The first process, producing puddled bars of superior quality, is consequently on a par with the fourth stage of the old system, as it avoids the necessity of the preceding separate manipulations. From the absence of all deleterious mixture, by once piling and reheating the rough



Scale ¾ inch to a foot.

A, The Hopper to contain the charge of ore and coal.
B, Preparatory oven or bed.
C, Wheels to regulate the supply of the mixture.
D, Shaft to which the perforated bottom E is attached.
F, Chimney, nearly double in area to that which is required on the old system of puddling.





Scale ¼ inch to a foot.

bars, iron is produced, of a quality in every respect equal, and in powers of tension superior, to that which results from the second piling and reheating in the common mode; it is therefore contended that the two processes produce from the hæmatite nearly one-third more iron, of as good a quality as is usually obtained by the six processes of the old system. The iron thus produced bears a high polish, is very uniform in its texture, is ductile and fibrous, having more than an average amount of tensile strength, and at the same time appears to be more dense, as it possesses a peculiar sonorousness, resembling that of a bar of steel when struck. It has also been converted into steel of a good quality.

The paper is illustrated by a drawing of the furnace necessary for the process, and by specimens of the iron and steel produced.

Remarks.—Mr. Clay contended that the ordinary method of making iron was neither so scientific, nor so practically good as there was reason to expect it would have been, when iron formed so considerable an item in the productive industry of the country. His invention was in some degree based upon the old Catalan fire, wherein malleable iron was produced direct from the ore, although by a considerable expenditure of fuel: by his process the ore was also reduced at one operation into the state of malleable iron, by combination with a large portion of carbonaceous matter; and as the deoxydation of the ore could proceed simultaneously in an adjoining preparatory bed, through which the flame of the puddling furnace traversed, there was necessarily a great saving of time, labour, and fuel in the production of the metal, while the quality was at the same time improved. He argued, therefore, that if the system was generally adopted, a large portion of the capital now sunk in the expensive constructions of blast furnaces, blowing engines, &c., would be dispensed with.

Mr. Taylor observed, that the process appeared to be only applicable to the rich qualities of iron ore, which were now used in comparatively small quantities, as a mixture with the clay ironstones of the coal fields, from which iron was generally produced in this country. There existed large quantities of hæmatite in Great Britain, equal in quality to that of Nassau, or of the Hartz mountains, from which so much iron was made, for converting into steel. The mines of Ulverstone alone now produce 50,000 tons annually, and at least 25,000 tons more could be shipped from Cornwall; and if a demand existed, there was scarcely a limit to the quantity that could be raised. He apprehended that the iron made by this process could be converted into good steel: this was very desirable, as it would render this country independent of Sweden and Russia, whence nearly all the steel-iron was now imported.

Mr. Heath had examined Mr. Clay's process of iron-making, and found that the wrought iron produced from a mixture of Scottish pig-iron and hæmatite ore, was of a superior quality, bearing severe tests without injury. The iron made by this method, from India pig-iron and specular iron ore (per-oxyde of iron) from Devonshire, which was identical in quality with the celebrated Elba ore, when converted into cast steel, by a process which he had accidentally discovered, possessed the quality of welding like shear steel, without any of its defects. The method he alluded to, was to combine manganese with the cast steel in the crucible, and when drawn out under the tilt hammer it could be worked and welded to iron, like shear steel: the consequence of this discovery was, that the latter quality of steel was almost abandoned for cutlery, and the former was now generally used, as it did not exhibit the laminated appearance when polished, which shear steel frequently did. The metal was sounder, and fewer wasters were made. All the brown hæmatites contained manganese, and there was little doubt that, by selecting the proper kinds of ore, malleable iron might be made in Great Britain by this process, as good for converting into steel as any of the Swedish iron. There was abundance of specular iron ore on Dartmoor, equal to the Elba ore, and which would (he had little doubt) produce as good iron as that from the Dannemora ore.

Dr. Faraday remarked, that the process invented by Mr. Clay was founded on sound chemical principles. It was desirable to abandon the use of limestone as a flux: it was proved that the purest limestones contained phosphates, which, although advantageous in agricultural processes, were detrimental in iron making.

Mr. Fox had tried some specimens of Mr. Clay's iron, and found them to bear severe tests, as well as the best cable bolt iron made in the ordinary manner.

Mr. Clay explained that Mr. Heath's process was not indispensable for converting into steel the iron made by his method; and also that argillaceous iron ores, after calcination, could be treated in his furnace, like the hæmatite ores, but not so advantageously.

Mr. Taylor said that 25,000 tons of steel were converted annually in this country, and of that quantity not more than 2500 tons were made from the best Swedish iron; for the remainder, inferior qualities of iron, such as Russian iron, marked CCND, from the forges of Monsieur Demidoff, were used. All that iron was made with charcoal, and could only be called inferior when compared with that made from the Dannemora ore. If Mr. Clay's process was successful in treating the hæmatite ores, as had been stated, it was of great importance, as it would emancipate the country from a dependence upon foreign products. He had recently seen in Germany, a process of producing steel by stopping the operation of puddling pig-iron at a certain point, or intermediate state between cast and wrought iron, and hammering the mass at once into bars. The operation was one of much delicacy, and depended entirely upon the skill of the workman.

Mr. Heath believed the manufacture of steel was involved in unnecessary mystery; it was the general opinion that foreign iron was essential to produce good qualities. Iron as now made from coke furnaces certainly contained too much foreign matter to be used for steel, and it would require more attention to the selection of the materials, before pure iron could be obtained; some of the Low Moor iron, the good quality of which was universally admitted, had been made into blistered steel, but although the springs made with it appeared perfect, it was said that they did not answer so well as those made with steel from charcoal iron. The Sheffield manufacturers required that steel should possess "nature and body;" the first quality to enable it to be rolled and drawn out without cracking, and the second that it might receive and retain a fine edge. Steel made from Garnderris iron (South Wales) possessed "nature," but if made into cast-steel it fled into pieces in working, as it did not possess "body." Steel from German ores appeared to have "body," but wanted "nature." Steel from

Indian iron, although difficult to work, stood better than other kinds when once reduced into form; this he attributed to the purity of the magnetic ore from which it was produced; there was not the slightest trace of phosphorus, arsenic, or any deleterious foreign matter. He was convinced that, with a mixture of Indian pig-iron (which could be produced very cheaply) and Devonshire ore, by Mr. Clay's process, iron could be made of excellent quality for converting into steel at such a reduced price as would render the introduction of Swedish and other foreign iron unnecessary.

Mr. Taylor believed that improvement in the quality of steel, rather than reduction in the price, was the object to be sought. In the large quantity used in the mines under his direction, the dearest steel was found to be the more economical. He had seen as many as 12 dozen borers used to make one blast hole, and unless the tools kept their points well, the labour of the men was thrown away.

February 21.—The President in the Chair.

Mr. Giles presented a plan and sections of London Old Bridge, made from his surveys of it in 1820, *by order of the Committee of the Bridge Lands, with descriptive notes.*

The plan represents the stirlings, piers, parapets, and roadway of the old London Bridge, its low-water channels, called locks, with the soundings through the locks. The sections represent an elevation and levels of the stirlings, piers, arches, roadway, and locks, with levels of the tides observed at the bridge in September and October, 1820; the datum to these levels being the Trinity high-water mark of London, which is recorded on a stone let into the lower external wing of the Hermitage entrance of the London Docks.[1]

From the plan it appears that—

	Ft.	In.
The aggregate waterway between the piers above sterling height was	524	2
The width occupied by the piers . . .	406	10
Making the total length between the abutments of the bridge .	931	0
The aggregate waterway below the stirlings at low-water was .	230	11
And the aggregate distance occupied by the piers and sterlings at low-water was	700	1
	931	0

The level of the tides shows—

	Ft.	In.	
The extraordinary high-water mark of springs to be	2	0	above datum.
The average high-water mark of springs between 23rd September and 25th October, below bridge	0	6½	under ditto.
The same above bridge	1	2	„
Making the high-water of spring-tides above bridge 7½ inches under the same high-water below bridge, owing to the obstruction which the piers presented to the tides attaining their full height above bridge: and this difference was found commonly to be 8 inches.			
The average high-water mark of neap-tides above bridge was	4	3	„
And the difference of high-water of neap-tides below and above bridge was not observable.			
The average level of low-water mark above bridge was	14	5	„
The average level of neap-tides low-water mark below bridge was	16	6	„
The average level of spring-tides low-water mark was	18	9	„

Thus the average fall of water through the locks of the bridge at neap-tides was 2 feet 1 inch, and the same at spring-tides was 4 feet 4 inches. But an extreme fall of 5 feet 7 inches was observed through these locks on the occurrence of a high land flood, and a spring-tide ebb.

Having completed the surveys of old London Bridge, Mr. Giles subsequently took the levels of the tides from thence to Teddington lock, and found that in the absence of high winds and land floods, the high-water of spring-tide on the upper side of London bridge attained its level or height at all the London bridges, also at Battersea, Putney, Kew, and Richmond bridges, and at Teddington lock.

"Account of a series of experiments on the comparative strength of solid and hollow Axles." By John Oliver York, Assoc. Inst. C. E.

The author first describes the causes of fracture in railway axles, which he attributes to the sudden strains and injury produced by concussion and vibration. Those resulting from concussion are chiefly ascribed to a defective state of the permanent way, any sudden obstacle opposing itself to the progress of the train, and the severe shocks arising from the wheels coming in contact with the blocks and sleepers when thrown off the line. The force of vibration and its certain effect to produce fracture in a body so rigid as a railway axle, is then fully explained; the evil arises from the impossibility of diverting from the axle the continued series of slight blows or vibrations to which it is subject, or of causing a free circulation of them through its entire length, since the naves of the wheels being fixed tightly on to the axles, form a point on either side for the vibrations to cease, and the particles of iron composing the axle at this point become dislocated by the continued and unequal strain, and ultimately break; the same action is described as taking place in the journal of the axle, and hence the fact that an axle seldom breaks excepting at the journal, or at the back of the nave of the wheel. The twisting strain to which railway axles are subject is next considered, and a calculation entered into, to prove that upon a circle of only a few feet in diameter and assuming a first-class carriage on four wheels to weigh six tons, the strain resulting from this cause is so slight as to be unworthy of consideration in the inquiry. The paper next proceeds to point out, how and why the hollow axle is better able to resist the strains before referred to, than the solid ones now in use.

First, by the process of manufacture, by which the crystallization of the iron is avoided, and it is left in a better state for sustaining sudden strains and continued action. Secondly, by the position of the metal composing the axle, since the comparative strength of axles are as the cubes of their diameters, and their comparative weights only as their squares, consequently, with less weight there must be increased strength; and thirdly, that the vibration has a free circulation through the length of the axle, no part being subject to an unequal shock from the vibration, and the axle would therefore receive much less injury from this cause. In conclusion, it is submitted that a railway axle should possess the greatest possible degree of rigidity between the wheels, to prevent it from bending or breaking from concussion, combined with the greatest amount of elasticity and freedom in the particles of iron within the axle itself, to prevent the injurious effects of vibration.

The details of a numerous set of experiments are then given, to prove the superiority of the hollow axle in all these respects, the average of the whole of which is thus stated. As regards rigidity to sustain a dead weight. The axles being supported at the ends, and the weights applied in the middle.

Hollow Axle.						Solid Axle.			
Weight.				Deflection.	Permanent set.	Weight.		Deflection.	Permanent set.
Tons.	Cwt.	Qrs.	Lb.	Inch.	Inch.	Tons.	Cwt.	Inch.	Inch.
7	14	..	6	$\frac{1}{16}$	..	7	14	$\frac{5}{16}$	$\frac{1}{16}$
9	2	..	..	$\frac{3}{16}$	..	8	1	$\frac{3}{6}$	$\frac{5}{32}$
9	16	..	..	$\frac{3}{8}$	$\frac{1}{8}$				

As regards its capability to resist a falling weight.

5 cwt. 3 qrs. 6 lb. falling from a height of 16 feet on to the centre of the axle.

Hollow Axle.	in.	Solid Axle.	in.
1st blow, deflection . .	1⅛	1st blow, deflection . .	1¾
2nd „ „ . .	2¼	2nd „ „ . .	3¼
3rd „ „ . .	3¼	3rd „ „ . .	4¼

As regards the elasticity and fibrous quality of the journals.

Hollow Axle.		Solid Axle.	
Number of blows to destroy journal (average) . .	28	Number of blows to destroy journal (average) . .	10

Proportions of axles.

	Hollow Axles.	Solid Axles.
Diameter	4 inches . . .	3½ inches.
Weight . .	1 cwt. 2 qrs. 20 lb.	1 cwt 3 qrs. 24 lb.

The paper is illustrated by specimens of the broken axles, both hollow and solid, and by diagrams of the mode of manufacturing the two kinds of axles.

Remarks.—Mr. Geach presented a series of specimens of ends broken off solid axles, made by the Patent Shaft and Axle Company, Wednesbury; they have borne severally 886, 148, 293, and 278 blows of a sledge hammer, weighing 38 lb. before they separated from the body: above twenty more ends had been broken off, the weakest requiring 138 blows. The diameter of these journals was 2¼ inches. An axle was exhibited which had been bent nearly double under an hydraulic press, with a pressure of 64

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[1] Low-water mark is 17 feet 10 inches below the lower edge of this stone, settled by the Corporation of Trinity House, August 1800, (39 and 40 Geo. III., cap. 17, sec. 55.)

tons: the journals ($2\frac{1}{2}$ inches diameter) were also bent in opposite directions, by repeated blows of the sledge-hammer, without any signs of fracture being perceptible. The firm, which Mr. Geach represented, had made upwards of 2500 axles, and had tried a very large number by breaking them: they almost uniformly found them of good quality, which might be attributed to the mode of manufacture. Around a centre bar of iron were placed eight bars rolled to a proper form to complete a circle; they were then welded together by rolling, and finished under the hammer; the fibre of the iron, it was contended, was thus worked, and remained in its most favourable position. He was not opposed to the principle of hollow axles, but he wished to prevent any unnecessary prejudice against solid ones by inferences from any one set of experiments; he would therefore suggest that another series of experiments should be made between the relative strength of the two kinds of axles, for which he would contribute the necessary number of solid ones.

Mr. York described the manner in which the solid axles had been selected for the purpose of experiment. Having obtained General Pasley's consent to be present on the occasion, he ordered axles from the Patent Axle Company, and another eminent maker, and selected also several other axles supplied by the Patent Axle Company to the London and Birmingham Railway; these axles were new, never having been under any carriage; he contended that the result of the experiments afforded a fair specimen of the axles generally in use, and were such as the public were in the habit of riding upon. The axles which had since been made by the Axle Company, and were then exhibited to the meeting, showed a quality of iron which could not be surpassed: if this was the usual quality made use of by that company, it still more forcibly proved his position as to the uncertainty of manufacturing solid axles, for while one specimen took a great number of blows to break it, the majority of them were fractured by a slight force; it was this uncertainty which he proposed to avoid, and he contended that it was inseparable from the method of making axles described by Mr. Geach, for in passing the faggot through the rolls to weld the bars together it frequently happened that they were only united to a depth of one-half or three-quarters of an inch, hence it was to a certain extent hollow, and partially avoided the injurious effect of hammering; if, on the contrary, they were perfectly welded, the iron became crystallized, as in any other solid axle; this fact was proved by the specimens before the meeting, those that were solid having been broken by very little force, and the unsound ones requiring a great number of blows to produce fracture. In the experiments, the hollow axles had broken under a different number of blows, but this was owing to their having been made of larger diameter in the journals than the solid ones (but with only an equal quantity of metal in them) and afterwards turned down to the same diameter, which left them of unequal thickness and too thin for a fair test; still, however, with less metal than in the solid ones, they were stronger; this might be accounted for by the mode of manufacture, as by retaining the axle hollow the crystallization of the iron was avoided. The present mode of making the hollow axles he described to be by taking two trough-shaped semicircular pieces of iron, bringing their edges together, and welding them under a hammer between swages. He however dissented from the process of hammering, and intended to finish his hollow axles by compression only. This, he contended, would avoid the injury done to the iron by the present mode of manufacture, and that with the same quantity of iron, the strength of axles being as the cubes of their diameters, and their weights only as the squares, a hollow axle must possess considerable advantage over a solid one. Hollow axles had long been considered desirable, but the expense of making them had hitherto prevented their use; he had reduced their cost by his process to the same rate as the solid ones, and felt confident that in bringing them under the consideration of the profession, through the Institution, they would be fairly treated and ultimately adopted.

General Pasley confirmed the correctness of the results recorded by Mr. York, and the satisfactory nature of the experiments, which had impressed him with a favourable opinion towards hollow axles. It was of importance to avoid deflection, as it was almost as fatal as fracture in causing accidents. After the late accident on the North Midland Railway, he observed a solid axle bent into the form of the letter C, and the upper portions of the periphery of the wheels nearly touching each other. The hollow axles would certainly resist deflection better than solid ones of corresponding weight.

In answer to a question, Mr. York said that the iron was chiefly injured by the amount of hammering which it received in forging.

Mr. Taylor remarked, that the question of the amount of injury received by iron in working, was discussed at the meeting of the British Association in 1842, and the effects of vibration and electricity had also been treated of by foreign engineers. It appeared to be generally admitted, that the great source of mischief was the cold swageing, which the iron received, in order to give the work a good appearance. In order to test this, Mr. Nasmyth subjected two pieces of cable bolt iron to 160 blows between swages. and afterwards annealed one of the pieces for a few hours. The unannealed piece broke with five or six blows of a hammer, showing a crystallized fracture; while the annealed piece was bent double under a great number of blows, and exhibited a fine fibrous texture. The fact of the fibre being restored by annealing was well understood and practised by smiths, particularly in chain-making.

Mr. York could not entirely subscribe to the great benefit of annealing, as he had found that after annealing one end of a hollow axle for 48 hours, it was broken off by 82 blows, while the other (unannealed) end of the same axle resisted as far as 78 blows.

In answer to a question from Alderman Thompson, Mr. York said that he had found as much mischief arise from over-heating iron as from over-hammering it; but the difference of the appearance of the fracture, indicated immediately when iron had been burned.

Mr. Taylor said that in Mr. Nasmyth's experiments, the over-heated iron was almost as fragile as glass.

Mr. Gravatt believed that vibration, whether caused by the smith in working the iron, or by the use to which the bar was appropriated, was the reason of its fracture, and it was certain that a constant change was going on in all manufactured iron. At the Thames Tunnel the "fleeting bars" used as levers for turning the large screws for forcing forward the shield, never lasted longer than three or four weeks, although they were very strong, and were made from the best materials by careful smiths. They were only used occasionally, and then without any concussion, having only the power of eight men exerted upon them: yet they broke constantly, and the fracture exhibited a bright crystallized appearance. It was found at last, that in order to give them duration they should be left rough, and not hammered much in working.

Mr. Newton observed that full 10 years since, Dr. Church had used hollow axles for his experimental steam coach on common roads, being convinced of their superiority.

Mr. Fox was an advocate for the hollow axles, but he did not consider the present experiments quite conclusive, as there were differences in the relative dimensions of the axles experimented upon; he would suggest another series of trials, upon a larger number of axles, as the subject was one of great importance, not only to manufacturers but to the public, whose safety in travelling depended upon the goodness of the axles under the carriages. He had used upwards of 5000 axles made by the Patent Axle Company, and had made many experiments by breaking them; the average result was equal to that quoted by Mr. York. He agreed in the danger arising from over-heating iron, as also from over-hammering it, and for some time past he had caused all the axles to be made six inches longer than was necessary, in order to cut three inches off each end, to try the quality and the appearance of the fracture of the iron.

The President remarked, that there could not exist a doubt as to the greater strength of a hollow axle, as compared with a solid one, both containing the same weight of material; the principal question to be considered was, that of vibration, and its effect upon the cohesive strength of the metal; whether the action upon the particles was more irregular in the solid body and more distributed in the hollow one; he recommended this investigation to some of the mathematicians who were present; the result of their inquiries might materially aid in the development of truth from the practical experiments.

February 28.—The PRESIDENT in the Chair.

"*Description of the Roofs over Buckingham Palace, covered with Lord Stanhope's composition.*" By Peter Hogg, Assoc. Inst. C. E.

The mixture invented by Lord Stanhope, and used by the late Mr. Nash, for covering the nearly flat fire-proof roofs of Buckingham Palace, is described in the paper as being composed of Stockholm tar, dried chalk in powder, and sifted sand, in the proportions of three gallons of tar, to two bushels of chalk, and one bushel of sand, the whole being well boiled and mixed together in an iron pot. It is laid on in a fluid state, in two separate coats, each about three-eighths of an inch in thickness, squared slates being imbedded in the upper coat, allowing the mixture to flush up between the joints the whole thickness of the two coats, and the slates being about an inch. The object in embedding the slates in the composition, is to prevent its becoming softened by the heat of the sun, and sliding down to the lower part of the roof, an inclination being given of only $1\frac{1}{2}$ inch in 10 feet, which is sufficient to carry off the water, when the work is carefully executed. One gutter, or water-course, is made as near to the centre as possible, in order to prevent any tendency to shrink from the walls, and also that the repairs, when required, may be more readily effected. It is stated, that after a fall of snow it is not necessary to throw it from the roof, but merely to open a channel along the water-course, and that no overflowing has ever occurred; whereas, with metal roofs it is necessary to throw off the whole of the snow on the first indication of a thaw. These roofs have been found to prevent the spreading of fires, and it is stated, that on one occasion, to test their uninflammability, Mr. Nash had a bonfire of tar barrels lighted on the roof of Cowes castle. Another advantage is stated to be, the facility of repair which the composition offers, as if a leak occurs, it can be seared and rendered perfectly water-tight, by passing a hot iron over it; and when taken up, the mixture can be remelted and used again. The author proposes to obviate the disadvantage of the present weight of these roofs, by building single brick walls at given distances, to carry slates, upon which the composition should be laid; instead of filling the spandrils of the arches with solid materials, as has been hitherto the custom.

The reported failures of this species of covering at Mr. Nash's house in Regent Street, and in other places, are accounted for by the composition having been used in one thin coat, laid upon an improper foundation of laths and tiles. The durability of the roofs, which were carefully constructed with good materials, has been, it is contended, fully proved at Lord Palmerston's house, which was covered with the composition in 1807; Lord Berwick's, in 1810; Sir James Langham's, in 1812; the Pavilion at Brighton, in 1816 and 1823; and nearly the whole of Buckingham Palace, in 1826 and 1829; the latter roofs are stated to be in perfect order at the present time, and have scarcely demanded any repairs since their completion.

The paper is illustrated by a drawing, showing the mode of constructing the roofs, and the improved method proposed by the author, with specimens of the composition, with slates imbedded, taken from the roof of the palace during some recent alterations.

Remarks.—Mr. Poynter presented a drawing of the mode of setting the pots for melting and preparing the composition, the proportions of which he stated somewhat differently from those given in the paper. Three measures of ground chalk, dried and sifted very fine, were mixed and kneaded up with one measure of tar; these ingredients were melted in an iron pot, set in such a manner that the flame should not impinge too violently upon it. The first, or "skimming" coat of the covering being laid on of a thickness of $\frac{3}{10}$ inch, the finishing coat was composed by adding to the former mixture three measures of hot sifted sand, well mixing the whole together; the composition was laid on with a tool similar to a plasterer's trowel, but much stronger. Mr. Nash, when he first tried the composition, found that the surface became disintegrated by exposure to the weather; he therefore added the slates imbedded in the second coat, and subsequently never used the mixture without them.

Mr. Nixon, in reply to questions from the President and other members, stated, that he was employed under Mr. Nash when the palace roofs were executed, and he could bear testimony to their durability and soundness. The roofs at East Cowes castle, which were covered with the composition in the year 1808, and those of the Pavilion at Brighton, in 1816, were now in as good a state as when they were finished. The failure at Mr. Nash's house in Regent Street, arose from the roof having been originally composed of mastic, which soon cracked. One coat of the Stanhope composition was spread over it, to stop the leaks, but it was insufficiently done, and ultimately Mr. Rainy had a new roof, properly constructed, with two coats of composition, which had remained sound to the present time. The price of these roofs, when well constructed by the person who did those of the palace,[2] was about five guineas per square.

Mr. Hogg observed, that the chalk was only exposed to such a heat as would evaporate any moisture it contained. The weight of the two coats of Stanhope composition, including the slate imbedded in it, was about 12 lb. per superficial foot.

Mr. Sibley considered the Seyssel Asphalte, when carefully laid, preferable to any composition of a similar nature; he had used it extensively, and was well satisfied with it, both for roofing and paving.

Mr. Hogg objected to the use of asphalte for roofing, as it was liable to injury, being of a brittle nature; it was not elastic, and it shrunk from the walls, thereby causing leaks. Lord Stanhope's composition did not possess these faults, and he did not consider that it was superseded by asphalte.

Mr. Moreland had covered the roof of the tread-mill at Giltspur Street Compter with asphalte, and had found it answer perfectly. It was laid on in a thickness of $\frac{3}{8}$-inch upon roofing boards, $\frac{3}{4}$-inch thick, with canvas nailed on them, with an entire fall of only 9 inches; there was not any appearance of leakage.

Mr. Davidson had caused a school-room to be floored with asphalte, four years ago, and up to the present time there was no symptom of wearing down, although the stones which were let into the floor, for supporting the desks, &c., were considerably abraded. He believed that the only failures of the asphalte had occurred from the use of inferior ingredients. Gas tar had been used instead of vegetable tar, and in those cases the result had not been successful.

ON BRIDGES.

At the ordinary general meeting of the Royal Institute of British Architects, held on Monday evening, the 15th May last, Professor Hosking illustrated and explained his proposal to improve the design of arched bridges, by the introduction of a transverse arch, groined into the longitudinal arch, or series of arches; and showed the effect of this and of other suggestions he has made for the improvement of bridges, in a design for re-modelling Westminster Bridge.

Mr. Hosking began by stating that the closely attentive consideration of the subject of bridge designing and building, rendered necessary by his engagement with Mr. Weale to supply a practical treatise for the extensive work on the Theory and Practice of Bridges, now lately published, gave rise to some suggestions of improvements in design and construction, which he believes to be novel, and knows to be (as far as he is concerned) original.

His object, on that occasion, was to explain and illustrate the more important suggestions he had made, that they might not be misunderstood, and might be more extensively known than they were likely to become whilst they rested within the covers of a professional library book.

On a former occasion in that room he had made some remarks upon the subject of bridge building generally, and had urged that the piers of bridges were built of much greater substance in thickness than was necessary for either safety or agreeable effect; that they might therefore be greatly reduced in bulk both for economy and for their effect upon the water way, and without diminishing their efficiency. It had been objected to him, however, at that time by some of the members—with the too common fault of architects, who would sacrifice use to effect, instead of compelling the useful to be effective—that his proposal tended to destroy the due proportion in appearance of the pier to the opening. The eye that had been accustomed to the bridges upon the Tiber at Rome, of which the piers are rarely less than one-third the span of the larger of the two arches resting upon them respectively, would be offended by the absence of that proportion of solid to void in London and Waterloo Bridges, in which the same relation is but one sixth; whilst the eye accustomed to the bridges upon the Thames at London, would condemn the bridges at Staines, and the bridges of Jena and Neuilly on the Seine, of which the piers are but one-eighth, one-ninth, and one-tenth of the span of the arches resting upon them. Nor have we yet reached the limit to which the diminution of proportion may be reduced with safety and good effect. Further to justify such further reduction, was one of the ends to be answered by the arrangement he was then to explain, which has the effect of reducing also the weight to be sustained by the piers of an arched bridge. The idea had occurred to him, and he had matured it so far, as to be able to speak of it with confidence on the former occasion alluded to above, but as he was then unprepared with illustrative diagrams, he had thought it better to withhold it for the time.

The proposed improvement consists in groining a bridge arch, or in carrying a groined transverse arch through the length of a series of arches; and the advantages derivable from this plan consist in lessening the weight of the bridging constructions; in reducing the thrust upon the abutments, and consequently confirming the stability of both arches and abutments; in diminishing the liability of the bridge constructions to vibrate under the action of pulsating or of rolling bodies; and generally in greatly reducing the cost of construction.

The weight is obviously lessened by the difference between the massive haunches of the main vaults, and of the requisite backing to them through the extent of the transverse arch, and the comparatively light inner transverse arch, which being of slight span, may be of stones of much less depth than the main vaults require; the thrust of the main vaults is clearly dissipated throughout so much of the width of the bridge as the inner transverse arch occupies, and so that if the latter occupy the proportion of the width that might be given to it, the abutments of the bridge may be reduced to mere wing walls; the vibrations arising from the traffic upon the bridge are checked at the groin points as at nodal points in a vibrating cord—and the groins lie directly under the carriage road where alone any action that could be felt in a heavy mass of masonry can arise;—and the cost of construction is reduced by the reduction in quantity of the materials in the piers and in the vaults—by the reduction of labour required for the softer stone available for the inner transverse arch, and by the lighter centering sufficient for the same.

He had endeavoured to illustrate his suggestions by applying what he proposed upon a compartment of London Bridge, as a familiar instance, but without any idea of reflecting upon the existing condition of that magnificent work. [Here Mr. Hosking explained the diagrams, which were merely enlargements of the plate which illustrate the same subject in the Treatise on Bridges.]

The only indication of such an arrangement as that he suggested, in any existing work with which he was acquainted, is in Perronet's Bridge of St. Maxence, where low arches are introduced over the divided parts of the piers transversely of the bridge, to take the springings of the great longitudinal arches, but these have neither the intention nor the effect of what is proposed, and are a source of weakness and expense rather than of economy and endurance. [The diagrams which illustrated this, showed that the transverse arch was low and flat, instead of rising to the full height of the great longitudinal arches, and must therefore exert a great thrust upon the divided portions of the piers which abut it; and as the vaults spring upon the backs of these transverse arches, there is no relief either in thrust or weight, by groining.]

He was well aware that the suggestion he had made was exposed to controversy upon the presumption that the transverse arch may not have sufficient abutment within the length of a pier, transversely of the bridge, and as the theory of the groined arch has not been satisfactorily determined, if indeed it have been really investigated, he must claim to refer to experience and assert upon example that the inner arch, as he had drawn it in the diagram, was superflously abutted. Under any circumstances, indeed, it can be only a question of greater or less span of the inner transverse arch with reference to the abutments afforded to it by the springings of the outer and greater longitudinal arch to which it is groined, since there can be no question but that if the abutments are sufficient to restrain the arch, the operation may be safely carried out. In the example the transverse inner arch occupies but half the length of the pier, leaving the minimum abutment equal to half the span of the arch, with the means of increasing it to almost any extent by raising buttresses upon the heads of the cutwaters.

Numberless instances exist of arches of far less rise in proportion to their span than the present example shows, abutted only by the piers on which they rest, or rather by a substance upon their haunches extending only to the thickness of their piers; the piers being far less in proportion to the span than in the example, whilst the proportion of abutment to span should increase as that of rise to span diminishes. Trajan's Bridge over the Tagus

[2] Mr. Millson, No. 6, Frances Street, Tothill Fields, Westminster.

at Alcantara, the Pons Palatinus or Ponte Rotto upon the Tiber at Rome, the ruins of Augustus's Bridge at Narni, are cases in point, and every cathedral chapter-house in England in the pointed style of architecture, and every arcaded cloister, furnishes another instance to the same effect.

Another question may arise as to the sufficiency of the area of the bearing surface upon the piers at the springings of the arches, for very much less is allowed than it has been usual to give in such cases.

Perronet calculated upon experiments, that the stone of which his Neuilly Bridge was built, is capable of sustaining twelve times the weight imposed upon it in the piers of that bridge. The area of the bearing surface of the piers of Neuilly Bridge, is about one-tenth of the area covered by the two half arches resting upon the piers respectively. In the supposed case, the weight of the superstructure, as compared with Perronet's, is diminished by the introduction of the perforation in the arches, longitudinally of the bridge, and the stone of which London Bridge is built, being stronger than the stone used by Perronet, in a much greater degree than the difference of their specific gravities would indicate; the substance of the arches built of the stronger stone, may be relatively reduced. These circumstances operate to such an extent, that the weight of the superstructure is reduced as compared with Perronet's work, nearly, if not quite, one-fourth; and as twelve times the sufficient strength is, besides, very much more than enough for the extremest contingencies, it is not too much to assume that the area of bearing surface of the arches at the springings, or on the piers, may be taken at one-fifteenth the area covered by the two half-arches. In justification of this assumption, it may be added that, without the same reason for it, but with flatter arches, certainly, than at Neuilly, Perronet made the area of the bearing surface upon the piers at the springings of the arches in the Bridge of St. Maxence, and with the same stone of Saillancourt, less than one-seventeenth the area in horizontal section of the space, covered by two half arches.

But the granite used in London Bridge, is of considerably more than twice the strength of the Saillancourt freestone in the bridges of Neuilly and St. Maxence, and upon which Perronet's experiments were made; and therefore the area of the bearing surface of the arches at the springings, may be one-thirtieth the area in horizontal section of the space covered by the two half arches resting upon any pier.

This is the proportion allowed in the case supposed, and the area of bearing face is upon the calculations regarding Neuilly Bridge, and having reference to the different powers of resistance of the two kinds of stone, more than enough for ten times the load it would be called upon to bear. Having reference, however, to other instances of the powers of stone to resist crushing pressure in the central pillars of some of the cathedral chapter houses, it may be safely concluded that experiments upon small pieces of stone give results much within the strength of the material in the block; so that having counteracted the tendency of the traffic upon a bridge, to induce vibration in the structure by the introduction of the deep transverse arch, groined to the flat longitudinal arches; it is believed that the bearing surface at the springings of the arches, and consequently, the piers under them, might be reduced, not merely with perfect safety, but with great advantage, very much beyond what he had now endeavoured to justify, in the example before the meeting.

Mr. Hosking then proceeded to explain the advantages of corbelling out the parapets on bridges, according to the method he has proposed in his treatise on Bridges; and read some passages in explanation of them, from that work: and showed, by diagrams, the manner in which the work might be composed constructively, and as to decoration, either plainly corbelled or enriched faces to the parapet. He then resumed his remarks, and stated that in closing his observations upon the design and arrangement of bridges, he could not avoid noticing a pressing instance of an important work, within the personal knowledge of all who live in, or have ever visited London, rendered by circumstances which have grown up around it, altogether unfit, both in its design and arrangement, for the position it occupies. In September last he wrote, in the *Treatise on Bridges*, as follows:—

"It is difficult to close a *Treatise on Bridge Architecture*, without remarking the increased unfitness of the present superstructure of Westminster Bridge. The arches spring at a level very little above that of low water, where the tide rises and falls from 15 to 18 feet, so that the water-way is nearly 50 feet, or about one-sixteenth less at the height of ordinary spring tides, than at the level of low water in the river. The arches contract the way for navigation much more than it is at all necessary they should, even upon the present piers, and there is more than twice the height from the soffits of the arches to the level of the roadway, than there need be; the parapets are alike offensive, by their great height from the roadway, and by their ugliness in detail, and injurious by the drafts induced by the perforations of the balustrades; and the solid counterfort buttresses over the cutwaters, and their inclosed and cupolated heads, add needlessly to the weight upon the piers. The bridge is unfortunately near to the magnificent buildings of the Houses of Parliament, and its great height renders this proximity more injurious than it might otherwise be. In all probability some abatement will be made of the height of the bridge in the process of the works now (1842) in hand for securing the pier, and doubtlessly the same good sense which opened a view of the river from Blackfriars' Bridge will open the magnificent prospect Westminster Bridge can command, by substituting parapets, which shall be truly so, for the perforated walls which now hedge in the road-way; but the arches will still continue to render the navigable water-way narrower and more inconvenient than even the multiplicity and thickness of the piers, or the condition of the work, impose. The character of the work, too, will still remain inconsistent with its position at Westminster. It ought, therefore, to be completely remodelled. As the piers are now in process of being repaired and secured, and so as to be free from any danger, founding new piers is out of the question, and the piers cannot be reduced in number without imposing additional weight on those which may be left; a condition which the original defective foundging, and the badness of the original structure, forbid. The whole of the superstructure might be removed, however, and the piers being carried up from the level of the present springing to that of high water, of the substance which the cutwaters now show within that range, flat pointed arches might be sprung at that level, and the whole superstructure re-constructed in accordance with the prevailing style of the Abbey, Hall, and Palace of Westminster. The longitudinal central groining hereinbefore proposed might well be adopted with excellent effect, lightening the upper works, relieving the thrust of the arches, and greatly economizing the reconstruction, as the old stone would work in well for this purpose, whilst the faces and main vaults were of new. The widening of the water-way by the removal of the springings of the arches out of the water would allow characteristic abutments to occupy the space now taken up by the two first arches of the series of thirteen, as well as the site of the two small land arches, without affecting the current injuriously; and as the flat pointed arch would give much more freedom to the navigation than the semi-circular arch affords, independently of the increased lateral space in every bay, the vertical head-way might be taken at an average of that now afforded by the central group. Moreover, the increased space at the approaches obtained by obliterating the useless land arches would allow the accesses to the bridge from the low ground on either side to be greatly improved, and the ascent eased by dividing them to the right and left over the abutments, and so to disrtibute the rise over a longer space, and give the means of dividing the going and coming traffic.

These observations, continued Mr. Hosking, coincide in a very remarkable degree, with those upon the same bridge, in the report lately presented by Mr. Barry, to the Commission on the Fine Arts, in connexion with the Houses of Parliament. It was true that his suggestions stood alone in the particulars in which it was almost certain they would be peculiar; as it regards the introduction of the inner transverse arch groined to the main vaults; the increase of the span of the arches upon the same piers, (for he did not understand Mr. Barry's report to contemplate that) and in widening, winding and dividing the approaches for the double purpose of use and delight. It was quite clear, however, that as his remarks were written in September of last year, and—with the wood-cut illustration of the subject which appears with the text—printed in October, though not published until February of this year, he might claim some credit for having taken the same view of subject that had already, he doubted not, presented itself to the mind of the their eminent contemporary, whilst it might be held to strengthen, in some degree, the view they had both taken, that it had occurred to both Mr. Barry and himself, without communication or knowledge indeed, of each other's doings, to support it by the same train of argument.

ELECTRIC TELEGRAPH.

MR. WHSHAW, the secretary, read a paper at the Society of Arts, on Wednesday, May 17, explaining Messrs. Cooke and Wheatstone's telegraph.

The practical electric telegraph comprizes two modes of applying electricity to telegraphic purposes:—1st. The "Galvanometer, which acts by the deflecting power of galvanometer coils on magnetic needles," and 2nd. The "Mechanical form which gives its signals through the agency of the Electro-Magnet on Mechanism." Every instrument yet employed may be classed under one or other of these heads; and it is only fair to Mr. Cooke to observe, that he had, previous to his acquaintance with Professor Wheatstone, worked out in detail, and made several instruments of both descriptions, and that he has alone thoroughly worked out the entire system on which these instruments are arranged for the purpose of making them act reciprocally.

Mr. Cooke, by profession a military man, having served in our Indian armies several years, was in March 1836, engaged at Heidelberg in anatomical researches in connexion with the interesting pursuit of modeling his own dissections from nature, for the embellishment of his father's museum, a professor of the Durham University. In this self-taught art he had been engaged several months. An occurrence about this time gave, however, an entirely new direction to his thoughts. Professor Moëncke of Heidelberg, had invited Mr. Cooke to witness some experiments with a simple apparatus, intended to illustrate the idea of giving signals by electricity—an idea, by the way, which had at that time been before the scientific world for several years. So powerful was the impression produced on Mr. Cooke's mind by these experiments, and so convinced was he of the possibility of applying electricity to the practical transmission of telegraphic intelligence, that abandoning his other pursuits, he devoted himself from that hour to the present moment exclusively to the practical realization of the electric telegraph—with what success, let those judge who have seen it working on the Blackwall Railway, for the last three years, or as now extended, and yesterday (16th May last) brought into operation for nearly 20 miles on the Great Western Railway.

It is no slight proof of the energy with which Mr. Cooke followed up his great object, in contradistinction to the proceedings of others who had been experimenting with the subject for many years, that within three weeks of his first conceiving the idea, he had constructed at Frankfort two galvanometer telegraphs, capable of giving 26 signals; he had also invented the detector, by which injuries to the wires, whether from water, fracture, or contact, were readily traced, an instrument which Mr. Cooke still retains in constant use; and without which, indeed, an electric telegraph would be impracticable: he had also invented the alarum, on the same principle as one of those in use at the present day.

But the leading feature of the invention at this early period, and which still most strongly distinguishes it from that of Messrs. Cooke and Wheatstone's telegraphs, and all others since exhibited in this country, consists in this, that the telegraph did not merely send signals from one place to another, but included a reciprocal system, by which a mutual communication could be practically and conveniently carried on between two distant places; the requisite connexions and disconnexions being formed by pressing the fingers upon keys similar in their action, and the signals being exhibited to the persons sending as well as to the person receiving the communication. This was and still is effected, by placing a system of keys permanently at each extreme end of the circuit of wires, and by providing a draw-bridge by which the circuit is completed for the electricity to pass when signals are received, but which is withdrawn when the signals are to be sent.

This united and reciprocal property is the basis of the electric telegraph, and inseparable from the practical system, and must be borne in mind when the operation of these instruments is explained. Mr. Cooke has since extended this instrument to any number of intermediate instruments included in the same circuit—as on the Blackwall line, where there are two sets, of five telegraphs each, working together—and also to the portable telegraph to be carried by the trains, and temporarily introduced into the permanent line of communication when required.

By Mr. Cooke's telegraph, eight simple signals can be given, and a sufficient number of compound ones, to admit of the 26 letters of the alphabet being used; in addition to which, by further conventional signs, those letters are made to represent figures, and by a mixture of both systems, as was shown, a mixed sentence, consisting of passages from a code, spelling and figures, could be telegraphed together.

Mr. Cooke first adopted the plan of laying the telegraph wires in iron tubing on the Great Western Railway, and afterwards laid down a double line on the Blackwall Railway, and others on the Leeds and Manchester, and Edinburgh and Glasgow Railways. This plan, though perfectly successful, was extremely costly and difficult to repair when injured, though by aid of an instrument, the detector, less difficulty than could be supposed offered itself to the detection of the injured part, though buried and out of sight. More recently, Mr. Cooke invented, after extensive experiments at his own residence, and carried out on the Great Western Railway, a plan of suspending the conducting wires in the open air from lofty poles. Its leading advantages are—1st. Diminished cost; 2nd. Superior insulation; 3rd. Facility of repair. The old plan consisted of laying copper wires, covered with cotton, and carefully varnished into smooth iron tubing—with frequent arrangements for obtaining access to the wires, and for the facility of examination and repairs. The tube, after being carefully tarred, was either buried in the ground or fixed on low posts, and covered with a wooden rail. This plan will still be occasionally applied in conjunction with the new one, in tunnels, towns, &c.

The cost of the original plan stands nearly as follows.

	£	s.	d.
Prepared ¾ tube, varnished within and without, 5½d. per foot .	115	10	0
Six copper wires, covered and varnished, at £6. 15s. per mile .	40	10	0
Labour and carriage, per mile	27	0	0
Iron fittings, boxes, &c.	12	6	0
Tar, pitch, paint, rosin, and sundries	15	0	0
Posts and rails, at 3½d. per foot, including fixing . . .	77	0	0
The total cost of the original plan per mile .	£287	6	0

To which a per centage for casualties, profit to the contractor, and the price of instruments remains to be added.

The cost by the present plan of suspension may be estimated thus.

	£	s.	d.
Drawing posts, with winding apparatus, per mile . . .	48	0	0
Cast-iron standards, with insulators, (22 in a mile) . . .	52	0	0
Labour in fixing and painting	12	6	0
Anti-corrosion paint and tar	11	0	0
Carriage, tools, and sundries	13	0	0
Contingencies	13	0	0
	£149	6	0

Making a reduction of about 50 per cent. in favour of the present plan—and a still greater advantage in favour of the permanency of the work.

The present method of proceeding in laying down the telegraph, is first, to fix firmly in the ground, at every 500 or 600 yards, strong posts of timber from 16 to 18 feet in height, by 8 inches square at bottom, and tapering off to 6 by 7 inches at top, fixed into stout sills and properly strutted. Attached to the heads of these posts are a number of winders for stretching the wires, corresponding with the number of conducting wires to be employed; and between every two of such posts, upright wooden standards are fixed about 60 or 70 yards apart. A ring of iron wire, (No. 7 or 8,) which has been formed by welding the short lengths in which it is made together, is then placed upon a reel carried on a hand barrow, and one end being attached to the winder at one draw-post, the wire is extended to the adjoining draw-post, and fixed to its corresponding winder at that post; by turning the pin of the ratchet wheel with a proper key, the wire is tightened to the necessary degree, thus the greatest accuracy may be attained in drawing the wires up till they hang perfectly parallel with each other. To sufficiently insulate the wires so suspended at the point of contact with the posts, is an object of indispensable importance, as the dampness of the wood during rainy weather would otherwise allow the electric fluid to pass off freely into the earth, or into an adjoining wire, and thus complete the circuit without reaching the distant terminus at which the telegraphic effect is to be produced. To effect this object at the draw-posts, wooden boxes are employed to enclose that portion of the post to which the winders are attached, and small openings are left for the free passage of the wires, without risking any contact with the outer box. The standards are furnished either with covers parted off by an overhanging fillet between each wire, and again between the lowest wire and the earth, or by a series of metal shields. An eye of metal, with a slit on the upper side, forms a hook to support the wire, and to insulate the wire from the hook, which might otherwise act as a conductor to any dampness in the wood, a split quill is slipped over the wire on which it rests. The whole is then carefully painted with several coats of anti-corrosion paint; or asphalte varnish may be employed for the wires. When the wires are to be varnished, they are unhooked from the upper ends of the standards, and lowered to nails temporarily fixed to receive them toward the bottom of the posts. A painter furnished with a can of paint, hung on his shoulder, a brush, and a piece of felt, takes each wire and rapidly coats it, when it is again hooked up in its position at the top of the standard. This is the simplest and cheapest method now adopted. But for long distances Mr. Cooke employs earthenware or glass for his insulation, and cast iron standards and posts with ash tops for drawing and suspending the conductors, which, instead of single wires, will be strands of six or more wires twisted together; for very great distances, when very superior conducting power will be needed, a copper wire will be placed in the centre of the strand, and whilst it adds but little to the weight, it will more than double the conducting power thereof, the iron wire still giving the necessary strength to resist tension. The relative conductive powers of copper and the softest iron wire are nearly as seven to one. Various methods are adopted in passing under bridges, which answer the purpose of draw-posts, the winders being fixed to a piece of wood partly let into the brickwork to avoid damp, the greatest enemy to electric conduction. These earthenware insulations are introduced between the winder and wire. Mr. Cooke also intends to use caps or boxes of earthenware to surmount the iron standards. At Slough, for half a mile in approaching and passing by the station, cast iron standards and draw-posts are employed, the effect of which is remarkably light and elegant; a line of six wires is there completed, and in crossing over a carriage shed immediately opposite to the station, the wires are stretched over a length of 438 feet without any intermediate support, and so accurately are they arranged, that no difference is perceivable in their parallelism: the draw-posts in this instance are half a mile apart, although the line is slightly curved. In passing over a station, or an accommodation road, or in crossing the railway, loftier standards are employed, which abruptly lift the wires to the height of 25 or 30 feet in order to clear objects passing below. In the latter case lighter wires are employed, that the tension out of the direct line of strain may not draw the standard from the perpendicular.

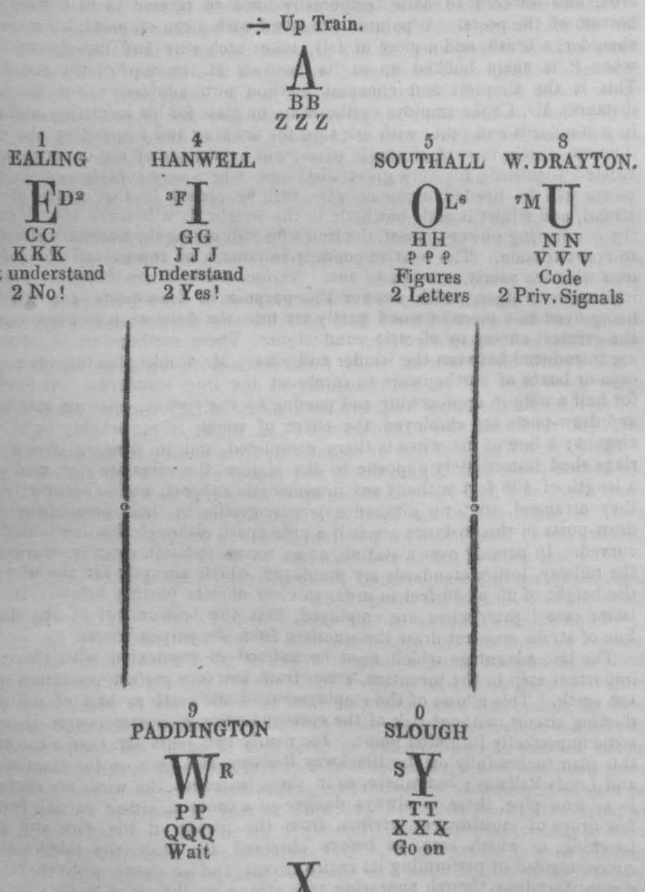
The last advantage which need be noticed in connexion with this very important step in the invention, arises from the very perfect insulation from the earth. This allows of the employment of the earth as half of the conducting circuit, without risk of the current finding a shorter course through some imperfectly insulated point. For nearly two years Mr. Cooke has tried this plan successfully on the Blackway Railway, and since on the Manchester and Leeds Railway; but where, as in these instances, the wires are enclosed in an iron pipe, there is always danger of a contact, either partial, from a few drops of moisture, or perfect, from the metals of the wire and pipe touching, in which case, as before observed, the electricity takes a short course instead of performing its entire circuit, and no signal is given at the distant terminus, though appearing very strong at the point whence it sets out. With the wires suspended in the air no such danger exists, whilst two advantages spring from the employment of the earth as a conductor. 1st, one wire is saved in each circuit, thus diminishing complexity and cost; and 2nd, the earth acting as a great reservoir of electricity, or as some think as an excellent conductor, the resistance offered to the transmission of the electricity is vastly diminished, and the battery is able to work through a much greater distance with a smaller conducting wire. It is thus that the apparatus exhibited can be made to work with two wires only.

Mr. Whishaw then explained the model of the telegraph. Upon moving the handle the poles of the battery are immediately brought in contact with the extremities of two wires, one of which passes forward to make coils around the galvanometer frame, in which the magnetic needles are suspended, and then proceeding to the distant apparatus to make similar coils there;

the other branch goes in the manner I explained to the earth. Thus, supposing the electricity really to find its way through the earth, it enters the corresponding branch at the distant apparatus, and passes into the wire which makes coils around the magnets, returning to the battery by the conducting wire, and producing the same divergence of the magnetic needles in both galvanometers, and indeed in as many, and wherever situated, as the electric fluid encounters in its course. When the handle is in the position of repose, the ends of the conducting wire and branch wire to the earth, are always in contact, forming a bridge for the electricity to pass from one to the other; but when the handle is turned the bridge is broken, and the wires are pressed in contact with pins connected to the battery poles; upon restoring the handle the battery is disconnected, and the bridge restored for the passage of the electricity from the other end. By reversing the movement of the handles the previous contacts with the battery are also reversed, the current passes in a contrary direction, and the needles change their deviation.

The simple signals are given by the movements of the needles either singly or combined; if both converge upwards A is meant, if downwards the stop. These signals are the same as in Professor Wheatstone's diagram, the remaining signals are additional. The left hand needle moving to the left gives E, to the right I; the other needle gives O and U; both pointing parallel W and Y. The consonants most in use are given by two movements of the needles, and those very rarely required, such as J, Q, X, Z, by three movements. C is used for K.

The following is a reduced diagram of the dial now in use upon the Great Western Railway, between Paddington and Slough. It has been proved to be capable of giving the twenty-six letters, numbers and various conventional signals at the rate of thirty per minute, it is worked by two handles in the centre between the two needles.



The Patent Street-cleansing Machine of which we gave a detailed account in our April number, has continued in daily operation in Regent-street. All parties express themselves perfectly satisfied with its performance, and anxious to see it generally introduced. A public company is now forming for working the machine in the metropolis and its vicinity.

METROPOLITAN BUILDING ACT.

We refrained last month from offering any opinion on the Bill now before the House of Commons, entitled "A Bill for the better regulating the Buildings of the Metropolitan Districts, and to provide for the drainage thereof," in consequence of not having had sufficient time to peruse it with that attention which such an important Bill requires. We have since carefully perused the whole of the Bill, and maturely considered it clause by clause, and we cannot do otherwise than at once pronounce it the most monstrous interference with public convenience and private rights, which was ever attempted by members of the English legislature, and if it be allowed to pass in its present state, we say fearlessly that it will be a disgrace to the architectural profession, for we understand that the Bill is the production of some half-dozen architects, to whom it was submitted to draw a new Bill to supersede the present Building Act.

This Bill appears to have been studiously framed to see how far the builder might be trammelled with expence, difficulties, fines and penalties; it not only contemplates enormous additional costs in the erection of buildings, but also taxes them with exorbitant fees to be paid to district surveyors, and a new fangled board to be called official referees, together with numerous other charges which we must submit in detail as we proceed with an analysis of the Bill. We shall not follow the Bill exactly in the order as the clauses stand, for they do not appear to be properly connected, but must connect them in such a manner as appears most desirable for the purpose of a proper understanding of the Bill. The number of the clause we have placed at the commencement of the observations, and those words within parenthesis, in italics, we propose to introduce, instead of the words previous.

4. The Bill proposes to extend the present district of the Building Act to the suburbs of the metropolis, and will comprise the following additional districts:—Fulham, Kensington, Hampstead, Hornsey, Stoke Newington, Stratford, Poplar, and Bromley, in Middlesex; in Kent, Woolwich, Charlton, Greenwich, Deptford, Lee, Lewisham, and Plumstead; in Surrey, Wandsworth, Tooting, Streatham, Clapham, and Battersea.

119. The magistrates to appoint the new surveyors, as heretofore, but the surveyors must not be less than thirty years of age; the present district surveyors to retain their present appointments.

15. There are to be three official referees to be appointed by the Secretary of State for the Home Department, for the purpose of determining the questions directed to be referred to them, and the determination of any two of such referees shall be binding on all parties; and if the parties agree, may be referred to one of such referees only, whose decision shall be binding in all respects.

It proposes to alter the present method of rating the size of the buildings, and instead of allowing the superficial contents of the building of dwelling houses, to regulate the rate, they are to be governed by the heights of the walls and the number of stories they contain, which part of the Bill, with some alteration, will be far superior to the present absurd system of ascertaining the rate by the plan.

5 and 6. There are to be eight rates of buildings, and the floors of all buildings are to be counted from the foundation inclusively, but exclusively of the rooms in the roof (if any), and the height, except in 5th and 7th rates, shall be measured from the surface of the lowest or first floor to the top of the wall or parapet of any one of the fronts thereof.

Here we must decidedly object to the rooms in the roofs of dwelling houses being excluded in the clauses, as it will keep up the present very equivocal mode of building by introducing curb roofs, which are nothing more than an evasion of the present art. We therefore propose that the rate of dwelling houses should include the rooms in the roof, and that an additional story, and a few feet in height, be added to each of the four following clauses; the alterations we propose are in italics.

7. First Rate.—Dwellings containing more than four (*five*) floors, and fifty-seven (*sixty*) feet high and not seventy (*eighty*) feet, and other buildings, not dwellings higher than 40ft. and not 50ft.

8. Second Rate.—Dwellings containing more than four (*five*) floors, and forty-seven (*fifty-three*) feet high, and not fifty-seven (*sixty*) feet, and other buildings 30ft. high and not 40ft.

9. Third Rate.—Dwellings containing three or four (*five*) floors, and thirty-three (*forty*) feet high, and under forty-seven (*fifty-three*) feet, and also every dwelling of a lower height with more than three (*four*) floors, and other buildings higher than 22ft. and not exceeding 30ft.

10. Fourth Rate.—Dwellings not having more than three (*four*) floors, and less than thirty-three (*forty*) feet, and other buildings not higher than 22 ft.

11. Fifth Rate.—Every building not a dwelling, brewery, distillery,

manufactory or warehouse, containing only one floor, and not exceeding 12ft. above the footings to the top of the wall.

It will be seen hereafter, in consequence of the additional thickness of the walls for fourth rate buildings to what they now are, that it will be a very serious detriment to the construction of small houses with only two stories, of which there are many thousands in the vicinity of London, and which we consider far better for the poorer inhabitants than having several families huddled together in one house containing numerous rooms; we therefore propose to meet this class of dwellings, and have them rated on the fifth class of buildings, for which purpose we propose to add to this clause the following words: *Every dwelling house which shall not have more than two floors, and which shall not exceed the height of 20 feet.*

12. Sixth Rate.—Every building 20ft. from any street or alley, and detached from any house, or building, or ground, not in the same possession, 50ft. The walls or inclosures (except chimneys) may be built of any materials, but if of brick or stone, shall be built according to their height, of the thickness required for the five preceding rates.

13. Seventh Rate.—Every building for the purpose of trade, or the collection of toll, detached, 15ft. from any other building, and which does not cover more than 100ft. square of ground, and is not higher than 12ft. from the ground to the highest point of the roof, may be inclosed with any materials except roof and chimney.

14. Eighth Rate.—"All churches, chapels, and places of public worship, theatres, exhibition-rooms, and other buildings whether included in the aforesaid rates or not, used either solely or at stated periods for purposes of public business, instruction, debate, diversion or resort, and also all breweries, distilleries, manufactories or warehouses which shall be more than 50ft. high, and also all dwelling-houses which shall contain more than seven floors or seventy *(eighty)* feet high: all such buildings to be built with party and external walls 4½ in. thicker, and when the carcase is built, the owner shall give 21 days' notice to the surveyor and to the official referees, who shall survey the said buildings, and within 7 days certify their approval of the same; or in case any part shall appear defective or insufficient, notice to be given in writing within 7 days to the owner, who shall forthwith alter and strengthen such defective or insufficient parts, and shall not cover up any such parts, until such surveyors and referees shall be satisfied.

128. And upon completion of such building, the owner, shall give 21 days' notice to the surveyor, and such surveyor, together with the official referees shall survey the same, and shall certify that such building has been built to their satisfaction, and such certificate shall be immediately filed by the clerk of the peace, and then it shall be lawful to use such building, and if used before the certificate is satisfied, the owner or occupier shall, on conviction before two justices, forfeit not less than five pounds, nor exceeding five hundred pounds daily (! !) until the filing of the record of such certificate. Provided always, "that if within 20 days from the assessing of such penalty such certificate of satisfaction shall not have been filed as aforesaid, such house or building shall be liable to be abated as a nuisance, under the powers in this act contained."—

	£.	s.
(129.) The surveyor's fee for surveying such building, in addition to a first rate fee	10	10
First rate fee	7	7
To each of the referees who shall have assisted in the supervision, and signed the certificate £10 10*s*. (three referees) ..	31	10
	49	7

And it is doubtful whether the official referees could not claim a farther fee, for clause 130, says—

"They shall in addition to the fees before mentioned have, and be entitled to, the following fees"

For every survey
For every certificate
For every award

the amount of the fees being at present left blank. We have now enumerated the leading features connected with this precious piece of legislature, regarding the eighth-rate of building, and we know not words strong enough to express our disapprobation of clauses most monstrous, whether we regard the exorbitant penalty of £500 a day, or the litigious spirit which breathes through all the clauses, or the extortionate fees which they propose. As clause fourteen now stands, it contemplates every school, literary institution, beer shop, public house, or tavern, all being places of public instruction, diversion or resort; banks, insurance offices, or in fact the offices of any joint-stock company, coming, it is to be supposed, under the class of buildings devoted to public business, are all to be classed within this rate of building; and it will be difficult to construe what is and what is not a building for public business. Although the district surveyor is appointed to inspect the works as they proceed, and stop them if they be not constructed to his satisfaction, yet when the building is covered in he has still, in conjunction with the referees, the power of ordering any part of the building to be taken down. If we are to have district surveyors, we must suppose them to be persons capable of performing their duties, and if so, why have the two special surveys directed to be made at the time of covering in the building, and when it is finished? The clause does not either compel the surveyor or referees to file their certificates with the clerk of the peace, and we cannot, therefore, think that any part of the clauses regarding the eighth rate of building will be allowed to remain in the bill, but be expunged *in toto*, as they ought to be, for the clauses of the rates and thicknesses of the walls is quite sufficient for all the purposes that the public have a right to expect for their protection; besides that, the proposed clause entails a delay of nearly, if not quite, two months in giving notice and waiting for the certificates. The effect of this delay in the case of a railway station will be palpable to our readers, very often entailing the postponement of the opening of the line until another season. As to the fee of 49*l*. 7*s*., what the church commissioners, the national school society, and the friends of education will say to it we scarcely know; 500*l*. is often the extent of the money which can be expended on a place of worship, school, or literary institution, and a tax of 10 per cent. on this amount is to be imposed. Where the architect often is not paid, and always insufficiently, it is rather too bad that money should be wasted on surveyors.

16. Attached buildings to be separately rated, and the external walls to be of the rate of which such attached building would be, if not so attached, but so far as regards the party walls, shall be held to be of the rate of the building of the highest rate *to which* such party walls *shall adjoin when such attached building shall be completed.*

This part relating to party walls is rather ambiguous, we suggest, that those words in italics be omitted, and that the words "*on either side of*" be introduced, instead of "*to which.*"

Thickness of Walls.—It must be recollected, in reading over the number of the floors, that the lowest floor of the building is reckoned the first floor, and in consequence of our proposal *(see ante)* that the rooms in the roofs of dwellings shall be counted, we suggest that the party walls above the upper room floor of the first and second rate buildings need not be so thick as provided, we have therefore given in *italics our own propositions*, and also an alteration for the thickness of the party walls of third rate buildings.

49. Footings of External and Party Walls.—Footings to be nine inches thicker than the walls above, and four courses high, and the top twelve *(six)* inches below the surface of the lowest floor, or six inches below the surface of the lowest ground.

50. First Rate external walls, 1 ft. 10½ in. thick, from footings to underside of the fourth floor, and 1 ft. 5 in. from thence to the top of the gutter plate, and the remainder 8½ in.

51 and 52. Second and third rate external walls from footings to the underside of the second floor 1 ft. 5 in. thick and from thence to the gutter plate 13 in. and remainder 8½ in.

53. Fourth Rate external walls from footings to top of gutter plate *(of upper room floor)* 13 in. and remainder 8½ in.

54. Fifth Rate external walls to have 2 course of footings, and 1 ft. 6 in. and 1ft. 1½in. thick, and above the footings 8½ in. thick.

79. Party Walls of first or second rate from footing to the underside of the second floor, 1 ft. 10½ in. thick, and thence up to the top *(of the upper room floor)* of 1 ft. 5 in. *(and thence up to the top of such party wall 13 in.)* and the party wall of the third rate from footing to the underside of the fourth *(third)* floor 1 ft. 5 in. and from thence to the top, 13 in.

80. Party walls of fourth and fifth rate to be 13 in. thick above the footings, excepting in a warehouse of the fourth rate, when it is to be 1 ft. 5 in. thick to the ceiling of the lowest floor.

56 and 82. Materials of External and Party Walls.—To these clauses we must call the special attention of our readers. They are to be built solid, of good sound well-burnt bricks or good sound stone, excepting such iron work as may be required for bonds and corbels, and excepting the ends of girders and bresummers, or tiers of door cases to warehouses, and the frames of doors and windows in external walls, all of which shall be fixed at the distance of 4 in. from the external face of such wall; and excepting such wood and iron work in the lowest or first floor and in the ground floor as may be required for brestsummers, girders and story posts, and excepting in party walls, flues, and such iron work as may be required to carry the ends of girders, brestsummers, trimming joists, and principal timbers of roofs, and the ends of all such girders, brestsummers and other timbers (in party walls) shall be carried upon iron shoes or stone corbels, built into the wall at least two-thirds of the thickness thereof to receive them, as shall also all trimming joists laying against such party wall. In another clause *(47)* it enacts that every girder or brestsummer which shall have a bearing on a party wall shall be laid upon iron or stone templates 6 in. thick, and the end of every such girder or brestsummer shall not be fixed into, and shall not have its bearing solely on the party wall, but shall be supported by a brick or stone pier, or iron column or timber story post, fixed on a solid foundation.

Now let us consider the serious effects of these two clauses; as they now stand, no place bricks can be used in any part, the consequence of which will be that the brick-makers will have great diffi-ulty in disposing of them, and must therefore increase the price of ock bricks. We consequently suggest the insertion of the words in clause 56 and 58, "place bricks may be used internally above the third floor of the first and second rate—and the second floor of the third, fourth, fifth and sixth rates of building." Neither can there be inserted into either party or external walls any timber for bond, lintels, plates, wood bricks, nor the ends of joists, or in fact any timber whatsoever, excepting as hereafter mentioned, the consequence is that the ends of joists, &c., must be notched on or framed into plates, and the plates must be carried by iron shoes or brackets, which will cause the plates to project into the rooms below the ceiling line; and it is a well known law that timbers whinh are fixed at their ends, as when let into walls, will bear double the weight, as when the ends are laid loosely on the bearings, as the case would be if the joists were laid on the plates, clear of the walls; nor are the plates so strong on brackets as when they are bedded into the walls, or the walls so securely tied in; we must therefore have an exception for the insertion of all necessary timber, for bond, plates, lintels, ends of joists, and wood bricks requisite to fix the joiner's work; but no such timber shall be inserted in the walls within four inches of the face of the wall, or within 12 inches of any flue, or inserted in any party wall more than five inches beyond the face; and by clause 47 above enumerated, for the purpose of supporting the ends of girders there must be a projection into the rooms under for the story posts or piers, which in dwelling houses will be a great eyesore.

65 and 66. CHIMNEYS.—No part of the chimney breast or stack will be allowed to overhang or oversail any lower part of the brickwork, either on the front or sides thereof, excepting a single chimney above the ceiling of the fifth floor of a first and eighth rate; or above the ceiling of the third floor of the second, third, and fourth rates, and it is also provided that no jambs, breast, and back of any chimney, and the front, back, or with of every flue shall be built at least $8\frac{1}{2}$ in. thick, and all the insides rendered or pargetted.

The effects of these two clauses will cause nearly the whole length and height of party walls to be at least three bricks thick, as the party wall on the upper story is generally filled with chimneys and flues; these clauses must be altered and a proviso inserted that chimneys shall not overhang more than 12 in. on the side in each story, and that the thickness of the flues be reduced to $4\frac{1}{2}$ in., and also that they shall be rendered or pargetted both internally and *externally* where they are below the roof, the rendering them externally we consider a far safer mode against fire than the increased thickness.

43, 44, 45, and 46. We have four clauses regulating the strength of timbers. They enact that no joists, rafters, or quarters, shall be more than twelve (*thirteen*) inches apart, and no joists have a longer bearing than 15ft. nor any rafter or purlin more than 11ft., and that no girders shall be so laid that the joists bearing thereon shall be more than 12ft. bearing. It is then enacted that the joists shall be not less than the following scantling.

bearing	Joists depth	Joists thick.	Trimmers depth	Trimmers thick.
6 ft. to 8ft.	$6\frac{1}{2}$	2	6	3
8 .. 10	8	0	8	$3\frac{1}{2}$
10 .. 12	9	$2\frac{1}{4}$	9	$3\frac{1}{2}$
12 .. 15	10	$2\frac{1}{2}$	10	4
Beams and Girders with a bearing				
9ft. to 12 ft.	9	6		
12 .. 15	10	7		
15 .. 18	11	8		
18 .. 21	12	9		
21 .. 24	13	10		

It is perfectly absurd to attempt to regulate the scantlings of timber, for there are such a variety of ways of framing timbers, and of combining them with iron, that it is impossible to meet all cases; besides, as the above clauses now stand, iron could not be introduced, excepting the girder be the same scantling as provided above, for the clause says, no joist, beam, or girder, shall be of less scantling than the above. The same remarks apply to the regulations of the scantlings of the roof and partitions. We therefore consider that these clauses must be withdrawn.

36 to 42. Regulations respecting the drainage of houses. The walls of any building must not be built higher than 10 feet before drains are properly built, and made good into the common sewer, if any within 100 ft. distance, into which it is lawful and practicable to drain or otherwise, into proper cesspools, so as to render such drains available for the drainage of the lowest floor; and the Commissioners of Sewers can also, upon giving one month's notice, compel every house already built and not drained, to construct proper drains.

These clauses respecting the drainage, had better be omitted until the proposed inquiry into the metropolitan sewers be concluded, and a Bill brought in for the regulation of the drainage and sewage of the metropolis, for as the clauses now stand, builders will be put to enormous charges, for constructing sewers as now compelled by some of the commissions, and the expense of draining a house into a sewer 100 ft. off may involve an expense of £100, for we conceive the sewer commissioners would not allow a small drain to be carried along under the streets, but compel the formation of a sewer which, in the Westminster division, will cost 1*l.* per foot for the second size (the smallest) sewer.

23. This clause enacts that, in any house already built, or which shall be hereafter built, it shall not be lawful to let separately except as a warehouse or storehouse, nor to occupy nor suffer to be occupied for hire as a *dwelling* place any room containing less than one square, nor any underground cellar or room of any dimensions, unless every such room shall have a window in the same to an open area and fire-place with flue, and an open area adjoining to such underground cellar or room, under a penalty of twenty shillings per day, the said cellar or room shall be so occupied.

25. No room less than eight feet high shall be used as a dwelling.

We consider these clauses require some explanation, and the word *dwelling* defined, whether a kitchen below ground used for domestic purposes during the day is considered as a room used for a dwelling, or whether it means a room in which a person sleeps; if the latter, we then conceive it will be better to introduce the word *sleeping* place or room instead of *dwelling*. We also consider it a great hardship to prevent the use of any room for a dwelling less than one square, or say 10 ft. square, or 12 ft. by 8 ft. 4 in. or 8 ft. high, of which there are many hundreds in the metropolis. This is carrying the provision for health rather too far, and will very considerably increase the expences of the poor for rent. If the word dwelling is construed so as to include a kitchen, then nearly every shop in London will have the basement rendered useless.

20. Hereafter no street shall be of a less width than 30ft., nor alley less than 20ft. wide when such alley shall have *two (one)* open entrance thereto, at *opposite sides or ends at* least 20ft. wide, *nor of a less width than 30ft. when only one entrance, and which entrance shall be at least 30ft. wide*; and the width of every street or alley shall be ascertained by measuring such width only as shall be given up to or used by the public.

This clause will increase the ground rents of small houses; we recommend that all those words in italics be omitted, and that the measurement be taken between the fronts of the houses, otherwise it will materially prevent the formation of areas and fore courts; the latter we consider better in alleys than having the whole space paved, which will render the repairs more expensive to the parish.

27. It shall not be lawful to carry on in any building, or in the open air, at a less distance than 50ft. from any other building or ground not in the same possession, any trade or business such as that of a soap-boiler, tallow-melter, slaughterer of cattle or horses, blood-boiler, bone-boiler, fellmonger, oil-cloth painter, manufacturer of gunpowder, detonating powder, lucifer matches, or varnish, gas works, chemical works, fire works, *or any other trade or business which is or shall be considered by two justices to be dangerous as regards fire, or dangerous or offensive or obnoxious as regards all persons, more especially those persons living or passing in the vicinity thereof*; nevertheless it shall be lawful for all such trades as now established to be carried on in their present situation, for a term of 30 years—every person who shall be convicted before two justices of carrying on such dangerous or offensive trade, shall forfeit any sum not exceeding fifty pounds, as the said justices may determine.

We pronounce this clause to be the most unconstitutional one which was ever submitted to the English parliament. Here we have the power of magistrates to determine what is an offensive business. Every baker, butcher, fishmonger, oil shop, and many other trades that perchance may be in the vicinity of any litigious person may, without notice, without summons, without a hearing, or without the power of appeal to a jury or to a quarter sessions, be ruined, their business stopped, and a fine inflicted of 50*l.* by two justices,—who may meet in their own private parlour, or in the house of some influential person who may demand their services, and expel any business which they think proper. That part of the clause given in italics must be omitted, and the other part altered.

We must now offer some observations regarding the magisterial clauses; the interpretation clause says:—"Two justices of the peace shall mean two justices of the peace for the county within which the building or other subject matter is situate;" it does not provide in any part of the Bill that they shall be in petty sessions assembled, which we consider most essential, otherwise cases may be heard at their own private dwellings, at any time and at any hour,—which we consider most objectionable; we would rather, that if the house be within the district of the metropolitan police offices, that the case should come before one of the stipendiary magistrates in the public police court; for here we have some responsibility, and a person by education brought up for judicial decisions; they will be called upon to adjudge upon severe fines and penalties, many of them are most enormous, but which no doubt will be altered. Nor is there provision that the parties committing an offence shall be first summoned and heard in defence; we therefore direct special attention to all the penal clauses, for the purpose of correction.

We must also direct attention to the subject of notices, which in many cases it says shall be served upon the owners; now, who is to determine the owner, and if he is known and residing 200 miles from the metropolis or in the country, how is a notice to be served? We consider that, if the notice be served upon the occupier, or the receiver of the rents if residing in London, it should be quite sufficient.

There are many other most objectionable clauses compelling occupiers to do repairs, &c., how they are to be done by many poor inhabitants who cannot raise sufficient to buy a loaf, we cannot tell; it is true that they can deduct the amount from their rent, but many of the repairs and other works requisite to be done must be done instanter on the occasion, subject to heavy penalties—besides, where will they find builders that will undertake to do the repairs, &c. for these p oor tenants, without first having the money paid down.

We must now direct attention to the fees to be claimed by the district surveyors, which are more than double those allowed by the present act, which are now maximum fees.

	New Buildings.		
	£.	s.	d.
First Rate	7	7	0
Second "	6	6	0
Third "	5	5	0
Fourth "	4	4	0
Fifth "	2	2	0
Sixth "	6	6	0
Seventh "	0	10	6

And for every alteration or addition one half the above fees—and also if any addition, although carried up at the same time as the main building, is to be separately rated, according to the heights, and a fee paid upon it.

These fees must be reduced to one half, or the amount of the present fees inserted.

We have already directed attention to the fees for eighth rate buildings.

There is one other evil attendant upon this bill—which is, that should a party lose a cause, he is to be mulcted in double costs of suits, in one case treble costs—this is a denial of justice; it is quite sufficient to deter parties from bringing actions vexatiously to amerce them in the payment of single costs of suits, which are rarely less than £100, if not double that amount on both sides if he loses; we must therefore urge that these inflictions of double and treble costs be omitted; besides, who is to be entitled to these additional costs? are the lawyers the parties to benefit?

We have now directed the attention of our readers to the principal clauses in this Bill, and pointed out many serious objections; there are others which we cannot now find space for, but we shall consider it our duty to submit a copy of the Bill, with our remarks and proposed amendments, to the Noble Lord who has charge of it in the House of Commons, and we must urge upon the profession, to come forward and remove the objectionable parts, or it will be a stigma upon the profession, with whom it is said to have originated.

STEAM NAVIGATION.

HER MAJESTY'S ROYAL STEAM YACHT "VICTORIA & ALBERT."

The launch of this singularly beautiful and magnificent steam vessel took place at Pembroke, on Wednesday, 26th April. The following are the principal dimension:—

	Feet.	inches.
Length, extreme	225	0
Length on the deck	205	0
Length between perpendiculars	200	0
Length of keel for tonnage	181	2
Breadth outside paddle boxes	59	0
Breadth for tonnage	33	0
Breadth moulded	31	11
Depth in hold	22	0

Burthen in tons, 1,049. She is divided into five water-tight compartments, and her engines by Messrs. Maudslays & Field, are of 450 horse power.

Her construction is entirely novel, and according to designs prepared by the Surveyor of the Navy; she is considered by competent judges to be superior, in point of beauty, buoyancy, and strength, to any other description of steam vessel ever produced in this country. Some idea may be formed of the novel and peculiar style of her construction, as well as of her great strength, when it is stated that she is built only with plank; the first two layers being of oak 1¾ inches thick, placed across each other diagonally at an angle of 45 degrees, the outside plank being of larch three inches thick, lying longitudinally or with the sheer of the ship, and the whole being bound up with vertical and diagonal iron bands. Between each layer of plank the surface is covered with thick tarred felt; the vessel therefore cannot leak, nor be in the least degree damp inside; and being divided into five compartments by four water-tight bulkheads extending as high as the state deck, it is impossible for the body ever to sink, although it might be bilged in any part from accident. Her keel was laid on the 9th of November, 1842, the anniversary of the birth of His Royal Highness the Prince of Wales, by Mr. William Edye, the master shipwright of the Royal Dockyard at Pembroke; and the greatest praise is due to Captain Superintendent Sir W. O. Pell, an officer of distinguished service and merit, and to the respective authorities, for the skilful arrangements and extraordinary exertions made in building this ship in the winter months in the short period of only 23 weeks. She would, however. have been completed in much less time, and been ready for launching by the 1st of March, but for the loss of a vessel with stores for her completion, in her passage round from the eastward, and the unavoidable detention of other vessels by the tempestuous weather in their voyage from the eastern dockyards to this port. She was brought round from Pembroke to the river Thames, and towed up the river to the East India Docks, Blackwall, on the 8th ult. and is now being fitted with her engines.

The Screw Propeller.—*The Mermaid*, (lately fitted with Messrs. Rennie's Stern Propeller, and by the same firm, with engines and boilers,) has made several experimental trips down the river, in order to ascertain her speed which was found (at the measured mile Long Reach) to be equal to 12¾ miles per hour through the water; after trying her at the measured mile, she was put alongside the *Red Rover*, (Herne Bay Steamer) which is said to go 13·25 miles through the water, but in running her from Long Reach Tavern to Gravesend (about 10 miles), the *Mermaid* gained about 300 yards on her opponent. These experiments fully prove that the "Screw" is nearly equal, if not quite. to the paddle-wheels. The engines of the *Mermaid* are of the nominal power of 45 horses each, her immersed midship section about 48 ft. We may observe that the lines of the vessel are not what they should be, for going 12¾ miles per hour; in fact, when she was built (4 years since), she was not considered a fine form for speed.

The "Peiki Tijaret."—(The Precursor of Trade.)—This fine vessel, built for the Ottoman Steam Navigation Company, for the conveyance of the mail and passengers between Constantinople and Trebison, made an experimental trip down the River Thames, from Blackwall to Gravesend, on Monday the 29th ult. There were present the Turkish Ambassador and Consul, the Egyptian Consul, and numerous distinguished foreigners, and a party of scientific gentlemen. She is the seventh vessel built in England for this spirited company. The vessel was constructed from the designs of Messrs. Ritherdon and Carr, by Mr Fletcher, and fitted with engines by the celebrated firm of Messrs. Miller, Ravenshill, and Co. Her dimensions are, length between perpendicular, 168 ft., beam 26 ft. 6 in., depth of hold 16 ft. 6 in., and draft 10 ft. 6 in.; burthen 568 tons O.M. She has a pair of beam engines of 90 horse power each; and are a beautiful specimen of Messrs. Miller and Co's superior workmanship; they worked with remarkable ease, and gave great satisfaction, as well as the build of the vessel, to all parties on board. Her performance at the "Measured mile" was equal to 11½ miles through the water; considering her immersed section, this was an excellent performance. On the return of the vessel to Blackwall, the Company retired to the "Brunswick" where a sumptuous entertainment was provided, which was attended by his Excellency the Turkish Ambassador, and the Consuls and other parties who were on board.

The Screw-Propeller.—We see by the Liverpool paper, that Messrs. Mather, Dixon, and Grantham, have been very successful with an iron vessel, the "Liverpool Screw" fitted with their patent improvements. The screw is worked direct without the intervention of spur wheels by the aid of a steam engine and boiler on the locomotive principle, consisting of two cylinders 13 in. diameter, and 18 in. stroke, and when light the screw makes about 85 revolutions per minute, the pressure of the steam in the boiler is about 50 lbs., and is used expansively. The vessel is 65 ft. long, 12 ft. 6 in. beam, and draft 3 ft. 9 in., the trials of her power in comparison with other vessels is said to be most satisfactory.

MISCELLANEA.

Payne's Patent for preserving timber from the ravages of the dry rot, insects, &c., is now likely to be brought into extensive operation; the process consists of impregnating timber with a solution of the sulphate of iron, and afterwards with the muriate of lime, which combines with the iron, and forms an insoluble chemical preservative, and by the process adopted, impregnates the timber to the very centre; this is effected by placing the timber in large iron tanks with the solutions, and then first exhausting the air, and afterwards readmitting it, and then using a force-pump, with a pressure of 200 lbs. on the square inch, to force the solution into the heart of the wood, which it does very effectively. Iron, as a preservative to timber, has long been known, and it is now, through the ingenious process adopted by Mr. Payne, likely to become very extensively adopted. The Company is now preparing the timber to be used at Claremont, for the royal stables, by command of the government.

A Congregational Chapel, at Derby, was opened on Wednesday, April 12th, designed by Mr. Stevens, architect, of Derby. The general plan is an oblong parallelogram, with a Tetrastyle Corinthian Portico at the entrance front, and a deep recess at the opposite extremity. It is elevated upon a stylobate, which affords a sufficient height for Schools and Class-rooms under the whole area. The Portico is approached in its whole extent by a flight of nine steps; the columns are 2 feet 10 inches diameter at the base, and the Eustyle intercolumination is adopted: it projects eleven feet, and is connected with the end of the building by square pillars, with corresponding antæ at the four angles of the building. The flanks are brought out to the face of the antæ, and have each five large semi-circular headed windows, with archivolts springing from continuous impost. The whole entablature of the order is continued round the building. A large arch under the Portico leads into a recess, which affords access on each side to the Lobbies, Staircases, and Chapel. The entrances to the Schools are screened in the front by a balustrade. The Chapel is 70 feet long, 45 feet wide, and 42 feet high, including the lobbies and entrance recess, over which the gallery is continued. The recess is filled by a Vestry, and gallery over, which is separated from the body of the Chapel by a bold elliptical arch springing from the impost. The Chapel is calculated to seat 700 persons, and admits of the accommodation being increased one-half by an extension of the end gallery, and the addition of other galleries on the sides.

Liebig's Compost Manure.—This distinguished chemist gives the following description for preparing a compost manure, which is adapted to furnish all the inorganic matters to wheat, oats and barley; it is made by mixing equal parts of bone dust and a solution of silicate of potash, (known as *soluble glass* in commerce,) allowing this mixture to dry in the air, and then adding ten or twelve parts of gypsum, with twelve parts of common salt. Such a compost would render unnecessary the animal manures, which act by their inorganic ingredients. The silicate of potash employed in the preparation of the compost, must not deliquesce on exposure to the air, but must give a gelatinous consistence to the water in which it is dissolved, and dry to a white powder by exposure. It is only attractive of moisture when an excess of potash is present, which is apt to exert an injurious influence upon the tender roots of plants. In those cases where silicate of potash cannot be procured, a sufficiency of wood ashes will supply its place."

Birmingham Canal Navigations.—The Bentley Canal, which has lately been executed by this company, under the direction of their engineers, (Messrs. Walker and Burgess,) was opened for traffic on the 28th of April. It connects the summit level of the Wyrley and Essigton Canal, near Wednesfield, with the Walsall, or lower level of the Birmingham Canal, near Darlaston, and both shortens the distance from the Walsall level to Wolverhampton, and opens up the mines about Willenhall and Bentley. Although the weather was unfavourable, a considerable number of the committee and principal officers of the company were present; R. Scott, Esq., M.P., acting as chairman *pro tem.* In proceeding along the line in the company's pleasure boat, the committee complimented Mr. Walker on the excellence of the work done by the contractors, and expressed much satisfaction at the quickness, and at the same time, the steadiness with which the boat rose in the locks. The total distance between the two canals, nearly 3½ miles, and 10 locks, (6 ft. 6 in. each rise) was performed by two horses in 57 minutes, the time occupied in passing through each lock having only been 45 seconds. The advantage of speed and steadiness combined, in working these locks, has been attained by making large paddles with improved machinery, and by introducing the water through culverts, extending under the side walls for their entire length, having a number of long shallow openings into the locks.

Iron Ships.—The Iron Queen.—We find that iron as a material for shipbuilding is fast gaining ground. For steamers iron has been a favourite for some time past, and there is not now one wooden steamer building at this port, while we observe there are two iron ones of the first class nearly completed, and we understand contracts are made for the building of three more. We are also now satisfied that the only objection to sailing vessels of iron—namely, the getting foul during a foreign voyage—is completely removed. This is proved by the result of two voyages by the *Iron Queen*. This bark, of 350 tons register, left the river Tyne in February, 1842, with 424 tons of coals for Havannah, whence she went to Mobile for a cargo of cotton for this port. She has now completed another voyage, from this port to Galveston, in Texas, carrying 300 tons of coals out and a full cargo of cotton home. She had been in the graving dock, where she was visited by many persons, and she is found not to have strained a single rivet, although she struch heavily on Galveston bar. There is no appearance of corrosion, the red lead being fresh on the plates, and neither shells, barnacles, nor any foulness was on her bottom. This desirable result is caused by the single application of a compound of tallow, bright varnish, arsenic, and brimstone, which effectually destroys marine vegetable and animal substances.—*Liverpool Albion.*

THE VARIATION OF THE COMPASS.

Observations made at the Royal Observatory, Greenwich,

G. B. Airy, Astronomer Royal.

Mean Magnetic		Declination.	Dip at 9 A.M.	Dip at 3 P.M.
		° ′ ″	° ″	° ′
1843	January	23 11 31	68 59	68 59½
	February ..	23 9 56	68 59¾	68 59½
	March	23 7 17	68 58½	69 1¼
	April	23 4 48	69 0	69 0¾

LIST OF NEW PATENTS.

(From Messrs. Robertson's List.)

GRANTED IN ENGLAND FROM APRIL 29, TO MAY 27, 1843.

Six Months allowed for Enrolment, unless otherwise expressed.

James Stewart, of 3, Gloucester-crescent, Saint Pancras, pianoforte-maker, and Thomas Lambert, of 91, Albany-street, Saint Pancras, pianoforte-maker, for "*improvements in the action of pianofortes.*—Sealed April 29.

Moses Poole, of Lincoln's Inn, gentleman, for "*improvements in making decoctions of coffee and other matters.*" (Being a communication.)—April 29.

James Hesford, of Great Bolton, Lancaster, millwright, for "*improvements in the manufacture of certain bowls and rolls.*"—May 2.

Josiah Longmore, of Regent-street, Kennington, silversmith, for "*improvements in pens, pen-holders, and pencil cases, part of which improvements are applicable to other useful purposes.*"—May 4.

Edward Morewood, of Thornbridge, Derby, merchant, and George Rogers, of Chelsea, gentleman, for "*improved processes for coating metals.*"—May 4.

Francis Daniell, of Camborne, Cornwall, assay master and analytical chemist, and Thomas Hutchinson, of Rosewarne, in the same county, esquire, for "*certain methods of obtaining or manufacturing lime from a substance or substances not hitherto made use of for that purpose.*"—May 4.

John Turnbull, of Holywell Mount, Shoreditch, card-maker, for "*improvements in the manufacture of horse-shoes.*"—May 6.

James Roose, of Wednesbury, Stafford, for "*an improvement or improvements in the mode or method of manufacturing welded iron tubes.*"—May 9; two months.

William Edward Newton, of Chancery-lane, civil engineer, for "*improvements in the construction of boxes for the axles or axletrees of locomotive engines and carriages, and for the bearings or journals of machinery in general, and also improvements in oiling or lubricating the same.* (A communication.)—May 15.

John Tappan, of Fitzroy-square, gentleman, for "*improvements in machinery for preparing and spinning hemp and such other fibrous materials as the same is applicable to.* (A communication.)—May 15.

Robert Alexander Kennedy, of Manchester, cotton-spinner, for "*improvements in machinery for grinding and sharpening cards used in carding cotton or other fibrous material.*"—May 15.

John Lucena Ross Kettle, of Upper Seymour-street, Portman-square, esquire, and William Prosser, junior, of Shaftsbury-terrace, Pimlico, gentleman, for "*improvements in the construction of roads, and in carriages to run thereon.*"—May 16.

Joseph Burch, of the City-road, engineer and machinist, for "*improvements in machinery for printing on cotton, silk, woollen, paper, oil-cloth, and other fabrics and materials, and certain apparatus to be used in preparing the moulds and casting surfaces for printing, and for certain modes of preparing surfaces previous to the design being delineated upon them.*"—May 16.

William Mills, of Foster-lane, glove-manufacturer, for "*improvements in fastenings for gloves and other wearing apparel, and in the mode of attaching the same.*"—May 16.

John Thompson, of Albury, near Guilford, doctor of medicine, for "*improvements in bedsteads and couches for invalids.*"—May 16.

Joseph Mazzini, of King's-road, Chelsea, gentleman, for "*improvements in typographical printing, combining the advantages of moveable types with the stereotype process by substituting for distribution a special font for each new work, by means of a pneumatic machine for casting, and a uniplane machine for composing.*" (A communication.)—May 16.

John Winter Walter, of Stoke-under-Ham, Somerset, glove manufacturer, for "*improvements in the manufacture of gloves.*"—May 16.

Robert Walker, Jun., of Glasgow, merchant, for "*improvements in propelling ships and boats.*"—May 18.

Charles Maurice Elizee Sautter, of Austin-friars, London, gentleman, for "*improvements in the manufacture of borax.*—May 22.

Christopher Nickels, of York-road, Lambeth, gentleman, for "*improvements in the manufacture of fabrics made by lace machinery.*"—May 22.

Alfred Poole, of Mornington-place, Camberwell, New-road, for "*improvements in drying malt and grain.*"—May 25.

Moses Poole, of Lincoln's-inn, gentleman, for "*improvements in the deposition of certain metals, and in apparatus connected therewith.*" (A communication.)—May 25.

John Gillett, of Brailso, Warwick, farmer, for "*an improved machine or apparatus for cutting or boring ricks.*"—May 25.

John Bushby Gibson, of Nantwich, Chester, Esq., for "*improvements in the manufacture of salt.*"—May 25.

Elijah Galloway, of Seymour-street, Euston-square, civil engineer, for "*improvements in the machinery for propelling ships and other vessels.*"—May 25.

Alexander Bain, of 326, Oxford-street, mechanist, for "*improvements in producing and regulating electric currents, and improvements in electric timepieces, and in electric printing and signal telegraphs.*"—May 27.

Richard Henry Billiter, of Maze pond, Southwark, oil merchant, for "*improvements in filtering oils.*"—May 27; two months.

Arthur Hill, of the Slad Parsonage, near Stroud, Gloucester, clerk, for "*an improved shower bath.*"—May 27.